AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

JUNE, 1958

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Precision Metal Molding

PMM

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

"Investment Castings cut cost, add strength in planes and missiles." . . . H. O. Williams; chief, quality control; Douglas Aircraft Co.

see page 3

Certified ZAMAK

ZINC BASE DIE CASTING ALLOYS

CERTIFIED uniform high-quality ingot can help you make better castings at high production speeds.

- All ingot is production controlled under the most modern methods to insure purity.
- Alloys are metallurgically checked to assure ingot meets your specifications.
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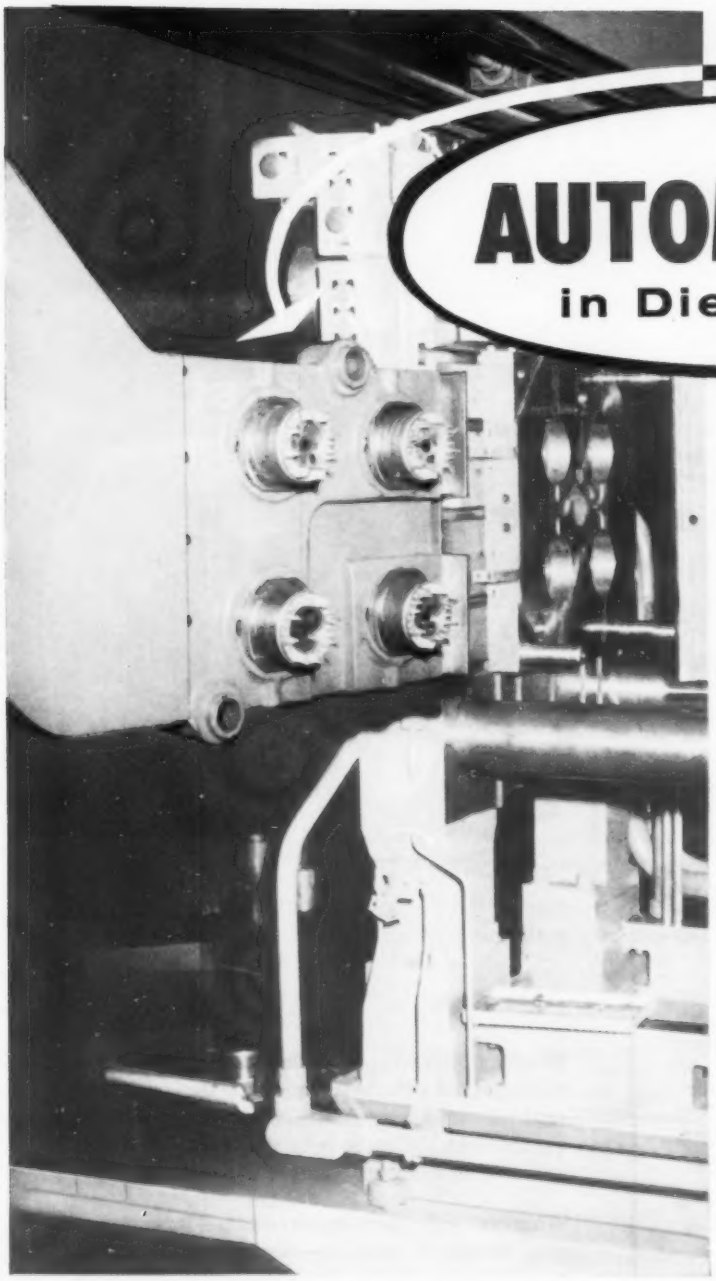


AUTOMATION
in Die Casting

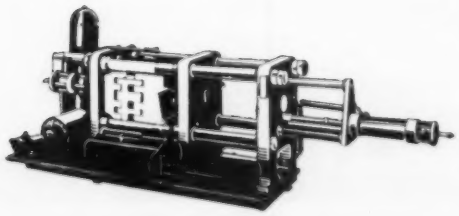
NEW! MULTIPLE CAVITY LOADER-UNLOADER

- Loads Laminations • Die Casts
- Trims • Unloads 4 rotors automatically

Another illustration of the pace-setting advances that are coming from Cast-Master! A major motor manufacturer gave Cast-Master the job of stepping up production and reducing labor on die-casting laminated rotors. Cast-Master solved the problem with this new, automatic loader-unloader. "Hydraulic muscles" load, trim, press out dummy shafts, unload automatically — cut costs while maintaining uniform quality. **One more example of the skill and know-how at your disposal when you turn your problems over to Cast-Master.**

FULLY DETAILED BROCHURE

Just off the press. Illustrated brochure giving complete details on this new CAST-MASTER loader-unloader. Phone, write or wire, and we'll get a copy to you at once.



Midwest Rep. C. W. Stone Co., Minneapolis, Minnesota
Eastern Rep. Milton Harmon, 18 Rock Rd., Milford, Connecticut
Western Rep. Sydney J. Wills, 2120 Strand, Hermosa Beach, California
Central-West Rep. Earl L. Johnson, 1696 Webster Lane, Des Plains, Illinois

CAST-MASTER *Inc.*

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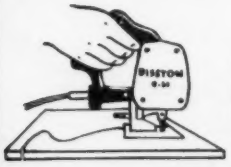
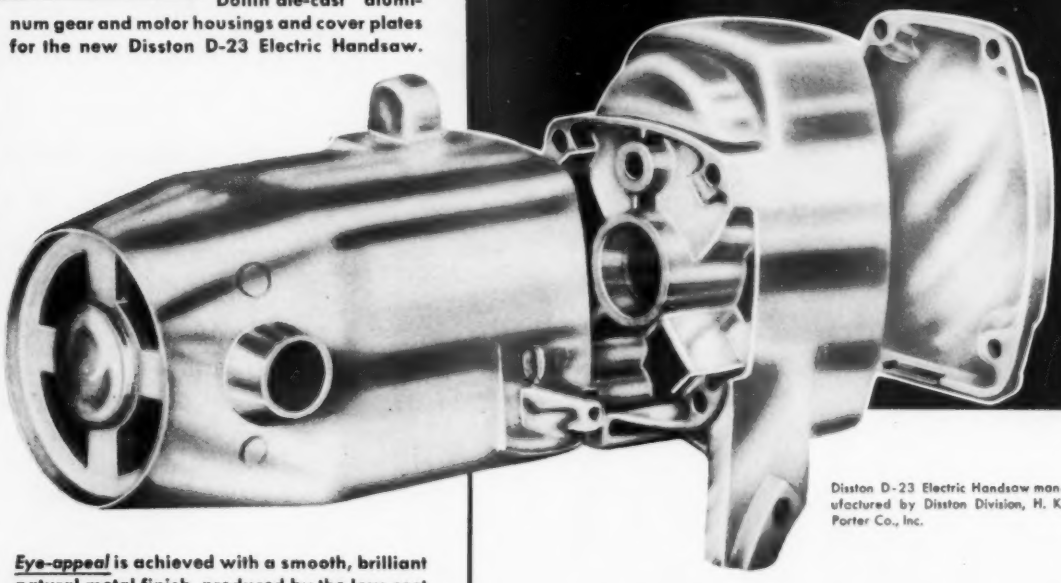
How DOLLIN DIE-CASTINGS add a quality look to a quality tool —at low cost



There's much more than meets the eye in the production of these streamlined, glistening Dollin die-cast aluminum gear and motor housings and cover plates for the new Disston D-23 Electric Handsaw.



Disston D-23 Electric Handsaw manufactured by Disston Division, H. K. Porter Co., Inc.

Eye-appeal is achieved with a smooth, brilliant natural metal finish, produced by the low-cost "Roll Brite" method. There is no surface preparation, plating or lacquering to cover up imperfections. The beauty is in the casting—assured by Dollin's exacting control of alloy purity and casting techniques to assure clean, sound castings with smooth, perfect surfaces.

Highest accurary of design and dimensions are maintained to match up perfectly in assembly.

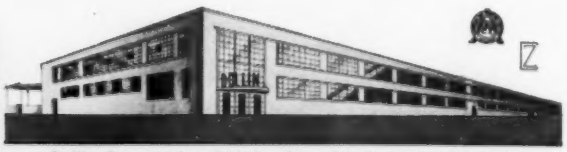
Light weight and strength are combined by using aluminum to withstand rugged usage and provide an easily-handled tool.

Low cost is obtained by Dollin die-casting methods to help keep this quality tool within competitive prices.

Meeting die-casting specifications like these and thousands of others, is typical of the great versatility, experience and specialized equipment available at Dollin to help you gain the fullest possibilities and economies of die-casting.

Whatever your parts requirements—large size or tiny, simple or complex—always submit prints or samples to Dollin for engineering advice or quotation, without obligation. Discuss your parts problems with the competent Dollin Die-casting engineer in your area.

DOLLIN Zinc and Aluminum **DIE-CASTINGS**



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COVER

110 MILLION DOLLARS worth of investment castings will go into planes and missiles. Some planes use up to 400 shapes and sizes of investment castings; a missile may use up to 50. Some 40-odd foundries will supply these castings.

High precision almost eliminates machining; strength approaches forgings; good grain structure permits the use of thin sections to hold weight down; duplication of intricate contours is good. These are just a few of the reasons why aircraft companies use investment castings.

And skilled advice is available too.. The cover picture shows H. O. Williams, chief, quality control and Ivar L. Shogran, chief project engineer of Douglas Aircraft Co. confering with E. G. MacLennan and Don Worthen, of Bone Engineering. The castings are for the Douglas DC-8 jet transport.

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One builder of heavy earth moving equipment has found self lubricating bearings are the answer to a serious problem.

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UCON
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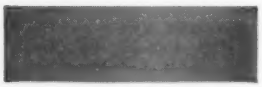
HYDROLUBES

HELP

PROTECTION The fire-resistance of CARBIDE's fire-resistant hydraulic fluids has been proved by severe, exhaustive laboratory tests. And, in actual service, water-base UCON hydrolubes have prevented serious fires and injuries during more than 10 years of routine use in all types of industrial hydraulic equipment. The common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. UCON hydrolubes are classified as acceptable, less hazardous fluids by Factory Mutual Laboratories.



ECONOMY UCON hydrolubes 150-CP and 275-CP are the economical answer to fire-resistance in hydraulic fluids. Most commercial hydraulic equipment can be easily converted to UCON hydrolubes with a minimum of time and expense. UCON hydrolubes have no harmful effects on most packings or seals. In fact, in many instances, reduced leakage losses have been reported. UCON hydrolubes also provide maximum protection against liquid and vapor phase corrosion and have outstanding anti-wear characteristics—thus, pump replacement costs are also held to a minimum.

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precise heat for precision casting

You'd *expect* the accurate heat of an induction furnace to be an important consideration in permanent mold, shell mold, and investment casting . . . and it *is!* But in addition to precise temperature control, Ajax-Northrup high frequency induction furnaces provide the precision foundry with *flexibility*, *purity*, and *economy*. That's why Ajax leadership in melting for precision casting has never been challenged.

One furnace—hundreds of alloys: Ajax-Northrup furnaces can handle any one or all of the hundreds of ferrous and non-ferrous alloys being made today. For many alloys, it's the only furnace that *can* be used. Magnet alloys, for example, depend on the inherent stirring action which assures ideal dispersion of all elements throughout a melt . . . and the most uniform possible cast part analysis.

Pure metal protects part quality: There's no flame, no smoke, no physical contact between coil and metal. Melts are always 100% on analysis, because there's no chance of contamination . . . particularly important when you're dealing with the finicky alloys common in precision casting.

A better melt at a lower cost per melt: Because every melt is uniform and to exact composition, bad melts become a thing of the past. Subsequent machining is minimized. Ajax-Northrup's unique control system assures maximum melting efficiency—lower melting costs. And new, compact designs minimize floor space requirements, installation costs and maintenance.

Induction heating & melting

AJAX

NORTHRUP

Available in every conceivable capacity from a few ounces to several tons . . . powered by massive motor-generator sets or economical converters . . . there's an Ajax-Northrup induction furnace sure to satisfy your needs perfectly. We'll gladly send you further information or, if you wish, arrange a meeting with qualified furnace engineers to discuss your special requirements. Ajax Electrothermic Corporation, Ajax Park, Trenton 5, New Jersey.

ASSOCIATED COMPANIES: AJAX ELECTRIC COMPANY-AJAX ENGINEERING CORPORATION

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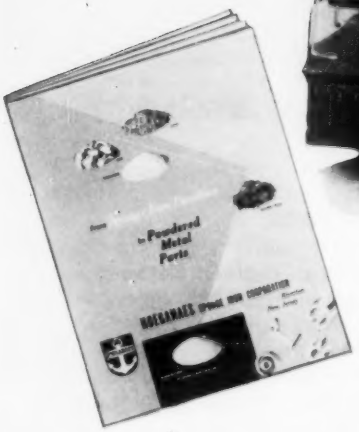
On Schedule since 1946... with **LIONEL**



Just off the press. Write for your copy of this fact-filled 12-page brochure that could be your introduction to powder metallurgy benefits in your metal parts production.

HOEGANAES iron powders assure dependable schedules

Over the years, as with Lionel Corporation, powder metallurgy fabricators and in-plant production departments come to know that *Hoeganaes iron powders are dependable.*

Dependable for parts dimensional control . . . for improved sintered strength . . . for increased production. Dependable for uniformity—from lot to lot—and year to year.

Since 1946, Hoeganaes has supplied iron powders to The Lionel Corporation. That's another way to spell dependability. For Lionel, pioneers of in-plant powder metallurgy production, can only rely on iron powders with year-to-year dependability.

The Hoeganaes Engineering Specialist would like to review the complete details of that "dependability story." He's as near as your phone. Ask for the facts, now.

HSIC

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

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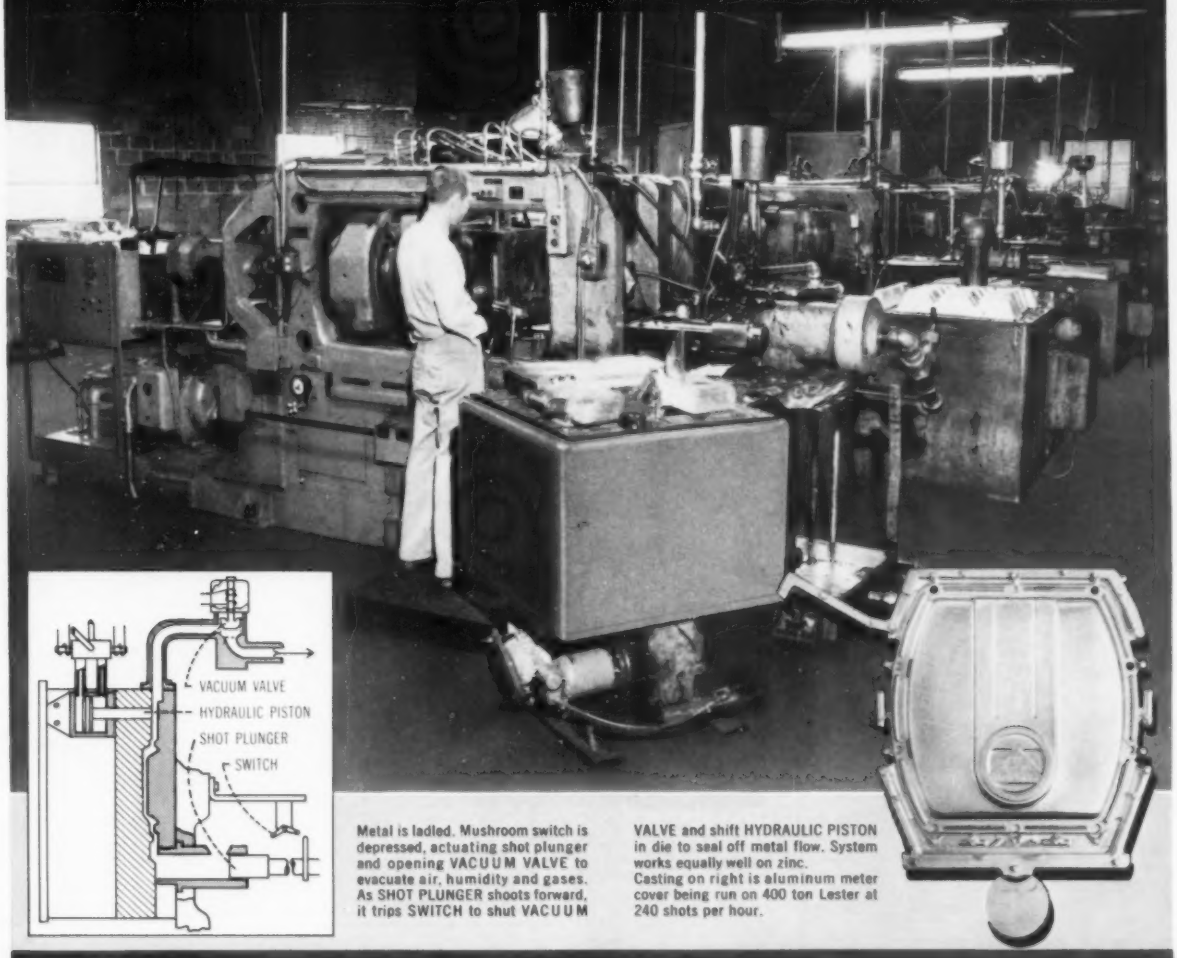
Another SUCCESSFUL VACUUM SYSTEM *applied to* LESTER MACHINES



Metal is ladled. Mushroom switch is depressed, actuating shot plunger and opening VACUUM VALVE to evacuate air, humidity and gases. As SHOT PLUNGER shoots forward, it trips SWITCH to shut VACUUM VALVE and shift HYDRAULIC PISTON in die to seal off metal flow. System works equally well on zinc. Casting on right is aluminum meter cover being run on 400 ton Lester at 240 shots per hour.

DESCRIBED AS A SERVICE TO DIE CASTERS

Here is the second simple, inexpensive high-vacuum system to be noted in recent months for use on Lester Die Casting Machines. The process was developed by Morton Manufacturing Co. of Omaha, Neb., for use on the 400 ton Lesters in their shop, and is now being offered for sale by them.

As successfully applied to a number of parts, the system evacuates the cavity of 95% of barometric pressure through a large overflow channel as the metal fills the die. When the cavity is filled, a switch is tripped to simultaneously shut off the vacuum and move a hydraulic piston in the overflow channel into position to seal off the flow of metal.

The system (patent applied for) incorporates the use of a Morton-developed self-expanding plunger tip, which seals against air leakage through the metal cylinder. No perimeter seal is required for the die.

As in the "New England" system, this process is completely dependent on a machine with a reliable clamp, capable of holding the die faces rigidly together to prevent flash and vacuum leakage. In this respect, the Lester machines are ideally suited to the process.

Here is another valuable tool for die casters. For additional details on this process, write Morton Manufacturing Company. For information on high quality die casting machines, write

LESTER-PHOENIX, INC.

2708-Y CHURCH AVENUE • CLEVELAND 13, OHIO

Agents in principal cities throughout the world

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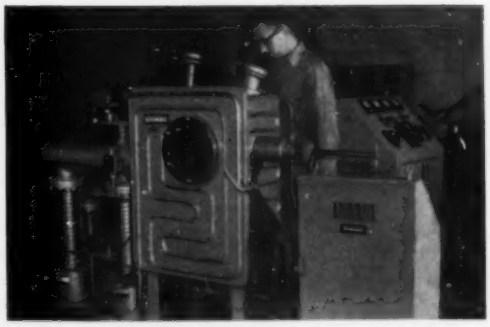
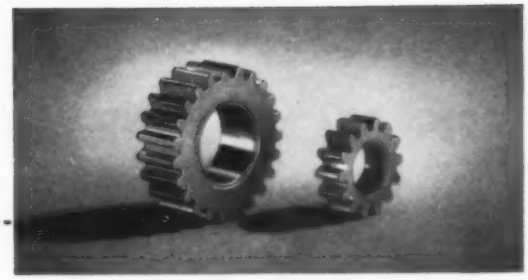
A section of the Supermet Division plant where miniature, close-tolerance gears and other parts are compacted to high density on Stokes presses.

OTHER STOKES EQUIPMENT



Stokes vacuum furnaces, available in a range of sizes, such as this Model 437-520, enable special alloying under vacuum, as well as the melting of metals susceptible to oxidation in normal atmosphere. Write for literature.

Enlarged 2½ times...the smaller steel gear is made to Commercial Grade 4 specifications, the larger one is made to Precision Grade 1 specifications. Both are pressed to 95% of theoretical density, are hardened to 30N64-69 specifications, and have tensile ratings of 130,000 psi.



Close-tolerance, powder metal parts pressed to high density at Supermet

Globe Industries, Inc., is the world's largest manufacturer of miniature precision motors. The Supermet Division, Dayton, Ohio, is a modern well-equipped powder metal pressing plant...supplies high-strength, close-tolerance gears for a variety of Globe's needs, as well as parts for other customers. When production of these precision parts was changed to powder metal pressing, substantial cost reductions were effected.

The Stokes equipment at Supermet includes one Model 294, two Model R-4's and two Model F-4's . . . with a third F-4 now on order. Some have already seen substantial service, yet all are regarded as "dependable machinery with very little down-time."

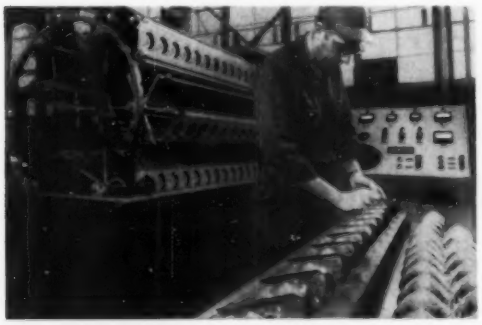
Typical of the Stokes line of equipment for powder metal pressing is the Model 640 . . . embodying such features as independent press adjustments and direct-reading calibrations, making it exceptionally easy to set up and to control from one centralized location. It, too, is designed for close-tolerance tooling and is uniquely suited for multi-level die work.

If you are now making metal parts by conventional machining methods, it will pay you to investigate the powder metal process and to call on the Stokes Advisory Service. This complete service can assist you in determining production costs . . . can handle complete laboratory production for sampling . . . includes design and fabrication of punches and dies, and recommendations for types of equipment. Write for complete information and literature.

Powder Metal Press Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

FOR METAL-WORKING PLANTS



Vacuum plating, in Stokes Vacuum Metallizers, produces a bright, attractive, metallic finish at far lower cost than electroplating. A complete line of self-contained, centrally controlled systems is available. Write for literature.

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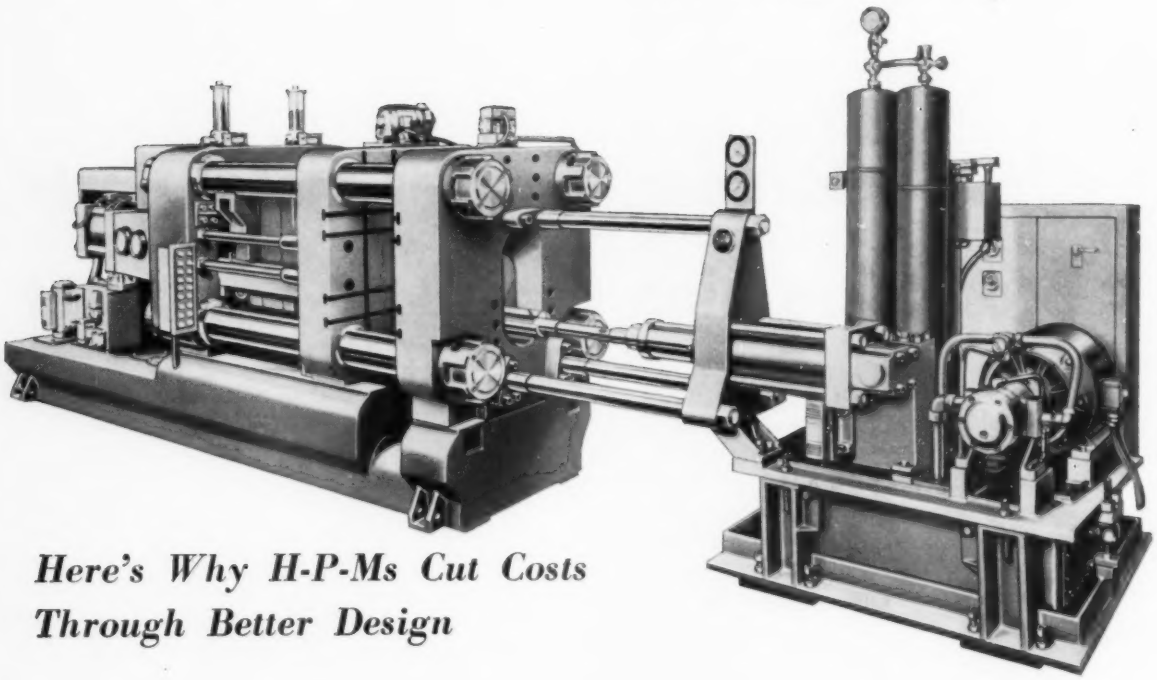
IF YOU DIE CAST . . .

H-P-Ms Give You More For Your Money



Here's Why H-P-Ms Cut Costs Through Better Design

H-P-M die casting machines are the answer to many of today's die casting problems . . . production output to meet any job requirement . . . cleaner castings . . . negligible flash . . . parts produced to accurate dimensional tolerances with improved quality and density. H-P-M's new design, mechanical link wedge clamp and new injection end, results in a new approach to die casting techniques. Here's why H-P-Ms are the best buy:

1. MORE "BEEF"—Heavier platens . . . more die support, less deflection. Larger rods . . . reduced flash, less trimming . . . more casting dimensional control . . . less die trouble.
2. MORE PRESS WEIGHT—Compare price per pound . . . you'll have difficulty finding an equal. In addition . . . H-P-M's many new design features.
3. MORE HORSEPOWER—Clamps to the rated tonnage . . . more pressure cycles per hour . . . higher injection speeds and pressures . . . positive and instantaneous injection follow through.
4. MORE SPEED IN DIE SET-UP—Single central screw adjustment changes daylight and controls tonnage . . . no tie rod nut adjustment.
5. MORE PRESS FLEXIBILITY—No die too complicated or sequence too elaborate. Infinitely adjustable . . . complete control of action, both clamp and injection ends . . . speed and tonnage assured when needed.
6. MORE SAVINGS IN MAINTENANCE—Self-contained clamp and injection ends . . . compact hydraulic power units . . . manifolded high pressure hydraulics . . . automatic lubrication . . . simplicity of mechanical link wedge design.

Write for Bulletin 5400-A, today

H817

THE HYDRAULIC PRESS MFG. COMPANY

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HPM

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If you apply heat to aluminum LINDBERG can show you the better way

Lindberg-Fisher electric resistance melting and holding furnace with Lindberg Autoladle automatic pump.

Heat and aluminum have been Lindberg's twin babies for many years. If the manufacture of your product requires the application of heat to aluminum anywhere along the line we can help you do the job better. For years our engineering and research staff has been creating improved methods and developing more efficient equipment in this field.

Most recent development is the Autoladle (we call it "Little Joe"), the first practical automatic aluminum ladling unit yet devised. Used with Lindberg melting and holding furnaces "Little Joe" (shown at the right) makes automatic casting of aluminum fast, dependable and economical.

Lindberg's Melting Furnace Division makes a wide variety of melting and holding furnaces for aluminum, brass, bronze, tin, zinc, lead and other non-ferrous metals. These include aluminum induction, nose-pouring crucibles, electric resistance holding furnaces and big reverbs. For foundry, permanent mold or die-casting plant, independent or captive, there are Lindberg melting and holding furnaces to fit your requirements. If your problem in this field needs a special solution Lindberg's design staff can find it. Just get in touch with the Lindberg plant or the Lindberg Field Representative in your locality, or write Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Ave., at Downey, California.

LINDBERG heat for industry

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CASTING ABOUT

technical news of applications & processes involving precision metal moldings

1957 WAS THE THIRD BEST YEAR FOR DIE CASTERS, exceeded only by 1955 and 1956. In fact, the production of aluminum die castings reached an all time high in spite of a severe fourth quarter drop in production. During the year the die casting industry used 376.5 million pounds of aluminum in castings alone, a 2.5% gain over 1956, the next best year. In addition 28.2 million pounds of aluminum were consumed in zinc die casting alloy. The total, 404.7 million pounds, is a new, all-time high.

While die casting consumption of aluminum was setting a new record, zinc was slipping just a little. For 1957 the total zinc consumption by the die casting industry was 703 million pounds. Only 3.1% below the 1956 high. But this consumption of zinc accounted for 38% of the total slab zinc consumption. Failure to set a new record was due to automotive cutbacks in November and December. The cutback, unfortunately, accounted for as much as 50% of the total production of some shops.

Copper consumption in brass die castings set another record in 1957. Total output of brass die castings was 10.5 million pounds, a copper consumption of 7.5 million pounds.

Magnesium die castings were the dark spot in 1957 with a drop of 12% below the record high in 1956. Consumption of magnesium for the year was only 5.4 million pounds.

A VERY RESPECTABLE DOLLAR VALUE of die castings shipped from contract shops was recorded in spite of the wide fluctuations in metal prices. For the entire job shop industry in 1957 sales of die castings were $416,500,000. In addition another $250,000,000 was spent with the die casters for machining, plating, painting and other finishing operations. Thus the gross sales of the industry are about $666,500,000. Of the $416.5 million spent for castings, division by metals was:

Aluminum	$193,500,000
Magnesium and Brass	13,000,000
Zinc	210,000,000

THE LARGEST CONTRACT FOR BERYLLIUM ever awarded was made by Centre d'Etude de l'Energie Nucleaire, of Belgium, to the Brush Beryllium Co.

The $1,200,000 contract calls for Brush to fabricate two core matrices for Belgian Reactor-2, a high flux materials and engineering test reactor now under construction in Belgium.

Each matrix consists of an intricate cluster of 64 hexagonal tubes in a unique geometrical arrangement. The tubes are three feet long and range from three to eight inches in diameter. They will house fuel elements, control rods and test regions of the reactor core. Each matrix will weigh approximately one and one-half tons.

Beryllium parts will be fabricated by powder metallurgical methods, the special QMV process developed by Brush for fabricating beryllium metal.

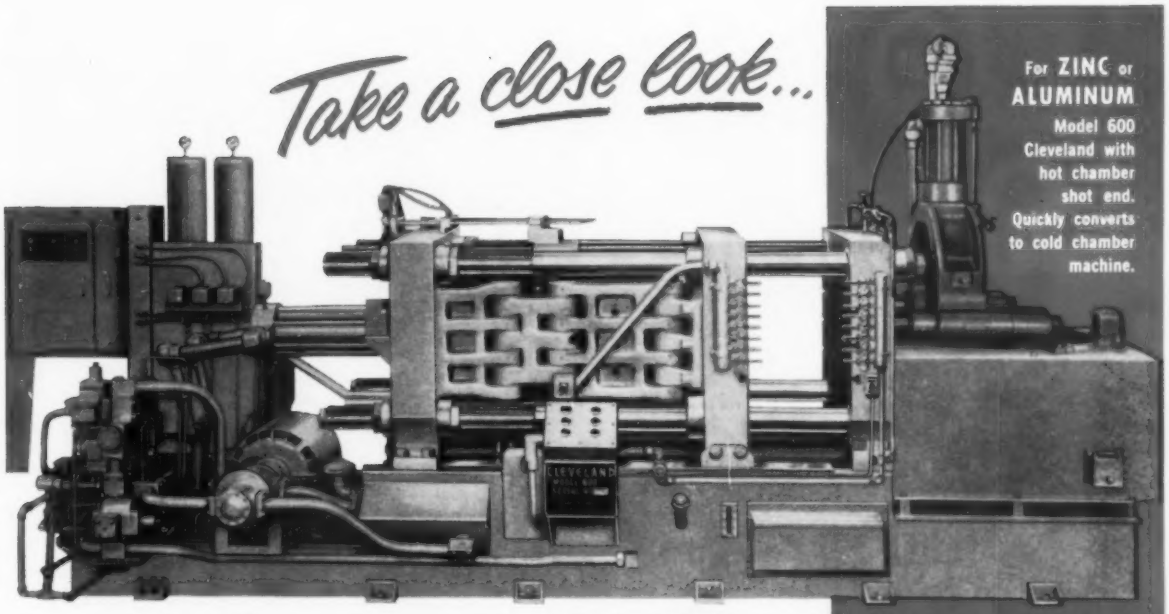
TOTAL DIE CASTING SALES BY ALL CONTRACT SHOPS are given in this detailed table prepared by the American Die Casting Institute. Motor vehicles and home appliances are the two greatest users of zinc and aluminum die castings. Magnesium castings are used most in machinery, tools, and motor vehicles. Brass is seen most in builders' hardware and in machinery and tools.

END USE DISTRIBUTION OF DIE CASTING SALES IN 1957
(By Weight, By Metal)
1957 Sales Distribution of Job Shop Produced Die Castings by Industry Groups

END USE OF INDUSTRY GROUPS	ZINC		ALUMINUM		MAGNESIUM		BRASS	
	% Of Total	Estimated Pounds	% Of Total	Estimated Pounds	% Of Total	Estimated Pounds	% Of Total	Estimated Pounds
Agricultural, Mining Construction Equipment	0.9	4,000,000	3.1	8,250,000	0.1	5,500	1.8	135,000
Automotive (Motor Vehicles)	56.9	256,000,000	42.8	115,000,000	37.4	2,000,000	4.8	360,000
Other Transportation	1.5	6,750,000	1.2	3,350,000	1.2	65,000	0.5	37,500
Industrial, Commercial Machinery and Tools	7.0	31,500,000	12.5	33,500,000	32.3	1,750,000	13.4	1,000,000
Electronic Devices & Communications Equipment	1.7	7,750,000	1.1	3,000,000	0.1	6,250	—	—
Office Equipment & Business Machines	3.9	17,500,000	7.5	20,000,000	7.7	425,000	0.6	45,000
Plumbing, Heating & Builders Hardware	5.1	23,000,000	2.1	5,750,000	—	—	59.8	4,490,000
Photographic, Optical, Recording Devices, etc.	2.1	9,500,000	6.1	16,400,000	3.9	215,000	0.5	37,500
Timing & Time Operated Devices; Clocks	1.0	4,500,000	1.1	3,000,000	—	—	1.6	120,000
Home Appliances	18.3	82,500,000	17.5	47,000,000	4.1	222,500	1.0	75,000
Toys, Sporting Goods Personal Goods & Jewelry	0.9	4,000,000	3.0	8,000,000	0.1	5,750	0.2	15,000
National Defense	0.7	3,000,000	2.0	5,500,000	13.1	705,000	15.8	1,185,000
TOTALS BY METALS	100.0	450,000,000	100.0	268,750,000	100.0	5,400,000	100.0	7,500,000

Source: American Die Casting Institute.

Take a close look...



For ZINC or ALUMINUM
Model 600 Cleveland with hot chamber shot end. Quickly converts to cold chamber machine.

at the new model 600 CLEVELAND

Cleveland's Model 600 brings to die casters a major advancement in die casting machine design. Its dozens of highly important features—many are exclusively Cleveland's — insure exceptional performance in delivering castings of precision quality at a fast production rate.

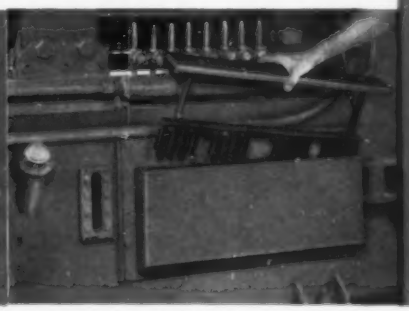
The "600" is *massive*—with guaranteed 600-tons locking pressure (strain gage tested). Maximum weight of shot is 10 lbs. aluminum and 25.8 lbs. zinc. It has 46½" x 46" die plates; 28" x 28" space between the tie bars; 30" max. to 10" min. die thickness; 8" to 15" die opening.

Only a few "600" features are illustrated here, but these are typical of Cleveland's all-over quality construction. For full details, call in a Cleveland sales engineer and write for new Bulletin 600.

New hot chamber shot end. Improved cast steel shot cylinder and gooseneck supports permit quick gooseneck removal. High pressure swivel joints in hydraulic lines.

Plus: Automatic timing control separate from machine, with push buttons convenient for operator's control . . . heavy, one-piece, machine-length base . . . extra rugged platens and toggles . . . dual accumulator system . . . manifold hydraulics . . . automatic lubrication . . . many other important construction features.

30 hp. totally enclosed motor drives two Vickers pumps which deliver 99.7 gal. per min. The 200 gal. hydraulic reservoir has filter capacity twice the pump capacity.



Magnet assemblies in hydraulic return line reservoir remove any metallic particles from the fluid. Adjustable bronze wedge supports for moving platen.

REMEMBER,
Clevelands Cut Costs!

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SALES OFFICES: CHICAGO
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

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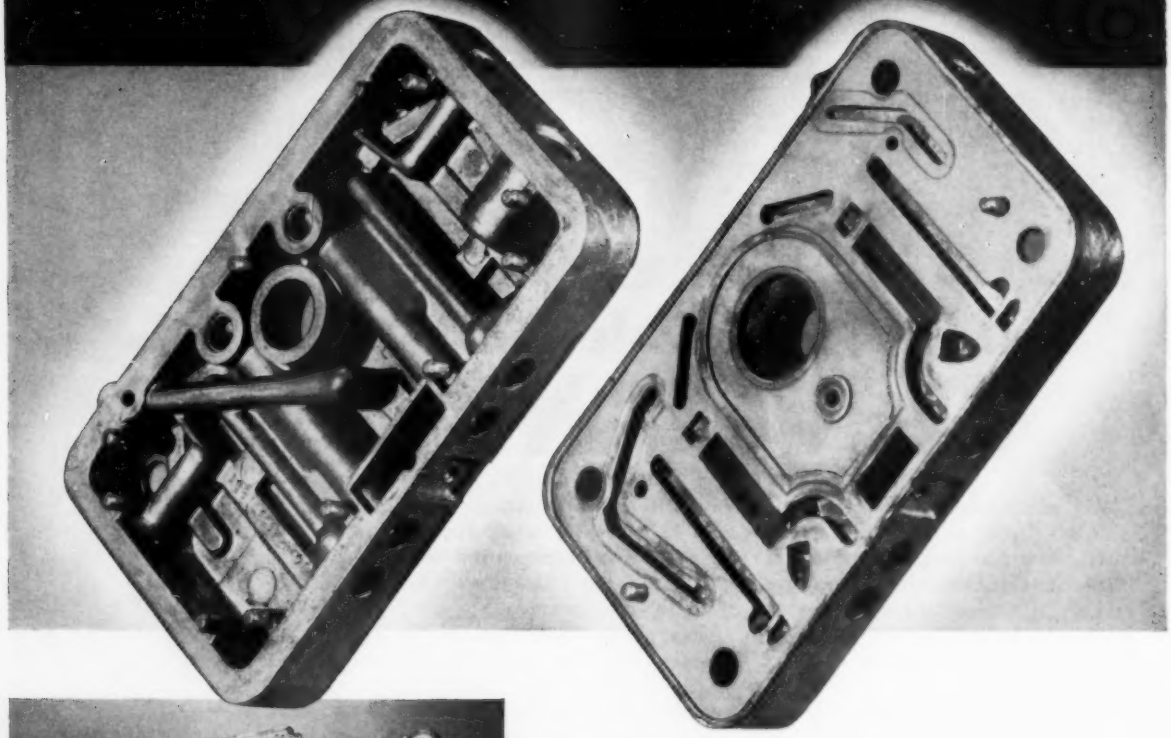
FOR *Extremely Complex Shapes* AND *Close Tolerances*

ZINC DIE CASTINGS ARE BEST



14 ZINC Die Castings make up principal components of the Holley four-barrel downdraft carburetor.

HOLLEY Carburetor Co. has these exacting metering bodies as well as 12 other principal parts of the Model 4150 carburetor made of ZINC because ZINC Die Castings are best suited for the job. Extreme complexity of shape of all these components, close tolerances of the air and fuel passages in the metering bodies and rigid efficiency requirements of the product demand the accuracy, strength, reliability and economy of ZINC Die Castings.

HORSE HEAD SPECIAL ZINC AND ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

DEVELOPERS OF THE MODERN ZINC DIE CASTING ALLOYS IN USE TODAY

160 Front Street • New York 38, N. Y.

HORSE HEAD PRODUCTS ®

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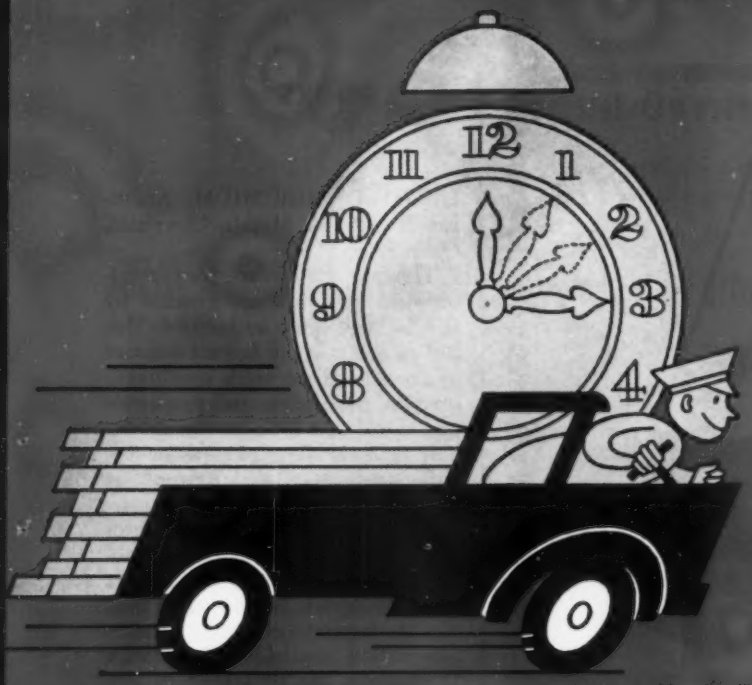

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Type H 13

DIE CASTING DIE STEEL

CALL ANY OF THESE WAREHOUSES AND OFFICES

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Dayton	BA 2-7451
Detroit	TY 4-0050
Hartford	CH 9-8613
Indianapolis	ME 8-7597
Los Angeles	HO 4-9191
Milwaukee	SP 1-3140
New York	WO 4-1970
Norfolk	MA 2-5347
Philadelphia	MI 9-2500
Pittsburgh	LO 3-5550
Rock Island	6-1221
Springfield (N.J.)	DR 6-3000
St. Louis	MI 7-4733
Syracuse	GR 2-7335
Titusville	7-2221
Worcester	PL 6-3563

THERMOLD AV STOCK SIZES · IMMEDIATE SHIPMENT

FLATS

1" x 2"	2" x 3"	3" x 4"	4" x 5"	5" x 6"	6" x 8"
1" x 4"	2" x 4"	3" x 5"	4" x 6"	5" x 7"	6" x 10"
1" x 6"	2" x 5"	3" x 6"	4" x 7"	5" x 8"	6" x 12"
1" x 8"	2" x 6"	3" x 8"	4" x 8"	5" x 9"	6" x 14"
1" x 10"	2" x 7"	3" x 10"	4" x 9"	5" x 10"	6" x 16"
	2" x 8"	3" x 12"	4" x 10"	5" x 12"	6" x 18"
1¼" x 2"	2" x 10"	3" x 14"	4" x 12"	5" x 14"	6" x 20"
1¼" x 4"	2" x 12"	3" x 16"	4" x 14"	5" x 16"	6" x 25"
1¼" x 6"	2" x 16"	3" x 18"	4" x 16"	5" x 18"	
1¼" x 8"			4" x 18"	5" x 20"	7" x 8"
1¼" x 10"	2½" x 3"	3½" x 4"	4" x 20"	5" x 25"	7" x 10"
1¼" x 12"	2½" x 4"	3½" x 6"			7" x 12"
	2½" x 5"	3½" x 8"	4½" x 6"	5½" x 8"	7" x 14"
1½" x 2"	2½" x 6"	3½" x 10"	4½" x 8"	5½" x 10"	7" x 16"
1½" x 4"	2½" x 7"	3½" x 12"	4½" x 10"	5½" x 12"	7" x 18"
1½" x 6"	2½" x 8"	3½" x 14"	4½" x 12"	5½" x 14"	7" x 20"
1½" x 8"	2½" x 10"	3½" x 16"	4½" x 14"	5½" x 16"	7" x 25"
1½" x 10"	2½" x 12"	3½" x 18"	4½" x 16"	5½" x 18"	
1½" x 12"	2½" x 14"		4½" x 18"	5½" x 20"	8" x 10"
1½" x 14"	2½" x 16"		4½" x 20"	5½" x 25"	8" x 12"
	2½" x 18"				8" x 14"
					8" x 16"
					8" x 18"
					8" x 20"
					8" x 25"

SQUARES

1" 1½"	2" 2½"	3" 3¼" 3½"	4" 6"	8" 10"

ROUNDS

½"	1"	2"	3"	4"	6"
⅝"	1¼"	2¼"	3⅛"	4⅛"	6½"
¾"	1½"	2½"	3½"	4½"	7"
⅞"	1⅝"	2⅝"	3⅝"	5"	8"
	1¾"	2¾"		5½"	10"

BILLETS

6"	8"	10"	12"	14"

UNIVERSAL-CYCLOPS STEEL CORPORATION

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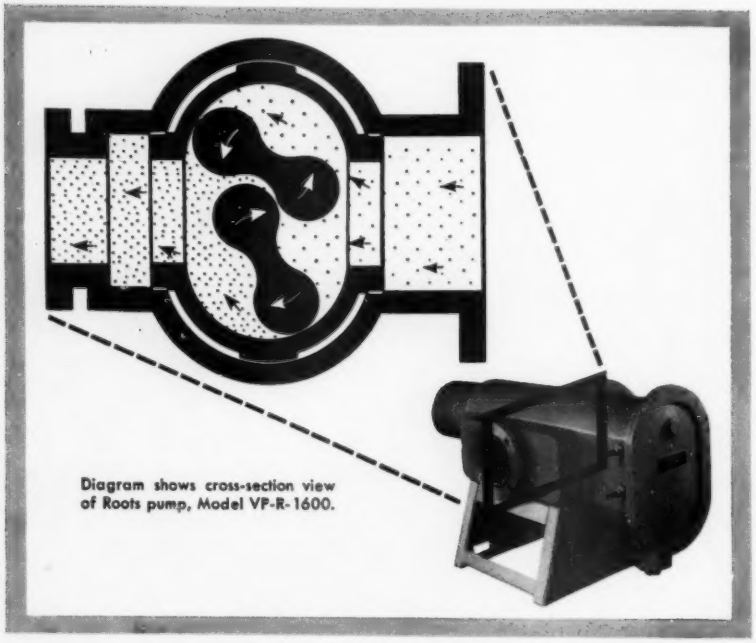


Diagram shows cross-section view of Roots pump, Model VP-R-1600.

How to get vapor-free high vacuum

fast . . . with the ROOTS pump

Now you can achieve completely dry pressure in the 10^{-1} to 10^{-5}mm Hg range using only a *mechanical* high-vacuum pump.

Probably the world's fastest pump in this range, the new Roots pump works without the aid of oil or steam vapors.

A pair of finely machined rotary pistons do the pumping. The pistons never touch one another or the pump casing, so the Roots pump needs no oil sealing. It cannot contaminate a system with backstreaming vapors.

Consider these other advantages:

1. Speed. The model shown above has a throughput of 10,400 micron cu. ft. per minute at 10 microns.

2. No shaft seals, no leaks. Motor operates within the vacuum.

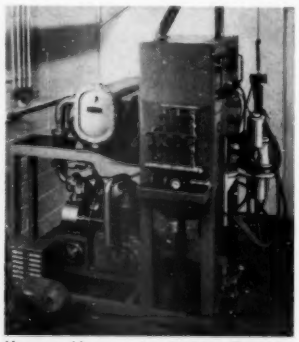
3. No by-pass or valving. Roughing is done directly *through* the pump.

4. Quiet. The Roots pump does not vibrate when in operation.

5. Low power consumption.

Under a license with the manufacturer, Heraeus (Hanau, Germany), CEC is exclusive agent for all seven models of the Roots pump in this country.

For data on performance and theory of operation, write for Bulletin P8-20.



Heraeus Vacuum Arc Melting Furnaces are also available from CEC. Note Roots pump used. Furnace melts "buttons" to ingots. Particularly useful for obtaining pure samples of metals with high melting points. Information in Bulletin P4-28.

Consolidated Electrodynamics

Rochester Division, Rochester 3, N. Y.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

For more information circle No. 17 on the Reader Service Card

PMM BOOKS

DUCTILE CHROMIUM, American Society for Metals, Cleveland, Ohio. Price $7.50

The new fields of use for chromium and its alloys are forecast by the findings of 49 authorities. This 376 page book is a factual account of the significant work on the extraction, fabrication and properties of a metal that is a most promising base for new alloys of superior oxidation resistance and strength at elevated temperatures.

Directed at the man who produces, extracts, tests, fabricates, designs and uses metals, the reports of the 49 experts on chromium contain the most recent and accurate information available. The book's 27 chapters are presented in five sections. Section 1 provides a general review of research on chromium. Section 2 deals with the production of chromium metal. Section 3 discusses ductile chromium metals, with Section 4 devoted to the effect of gas on chromium metal and Section 5 reports on high-chromium alloys.

A 14-page name and subject index and 220 charts, tables and photomicrographs are included.

THERMAL STRESSES, By B. E. Gatewood, McGraw-Hill Book Co., Inc., New York, N.Y. Price $7.50

At last here is a book that is not limited to the age-old thermal-stress problem of finding the elastic thermal stresses for a given temperature distribution in a structure with no buckling. This book touches on all phases of the structural-design problem at elevated temperatures — temperature distribution, elastic and inelastic thermal stresses, combined applied and thermal stresses, allowable stresses of various materials at elevated temperatures, and the buckling, deflection, stiffness, fatigue, shock, and flutter effects of elevated temperatures.

The book places its emphasis on fundamental theory. The material presented is applicable to many types of machines — aircraft, nuclear reactors, rocket motors, steam and gas turbines and their design, and guided missile air frames.

METAL POWDER INDUSTRY FORMS UNIFIED FEDERATION

Federation of individual powder metal industry groups into a new organization known as the Metal Powder Industries Federation, creates a successor to the old Metal Powder Association.

The MPI includes four trade divisions: The Metal Powder Producers' Association; The Ferrite Manufacturers' Association; The Metal Powder Core Association; and The Powder Metallurgy Equipment Manufacturers' Association. Each trade group is still a separate organization with its own officers, by-laws, and budget.

The formation of MPI gives each segment of the industry an independent status, yet encourages group action in development of the industry.

Because most uses for metal powders involve the science of powder-metallurgy, MPI includes a technology division which functions through the newly created American Powder Metallurgy Institute. Its main responsibility is in technical development.

The institute has equal status with the trade divisions as part of the federation of MPI.

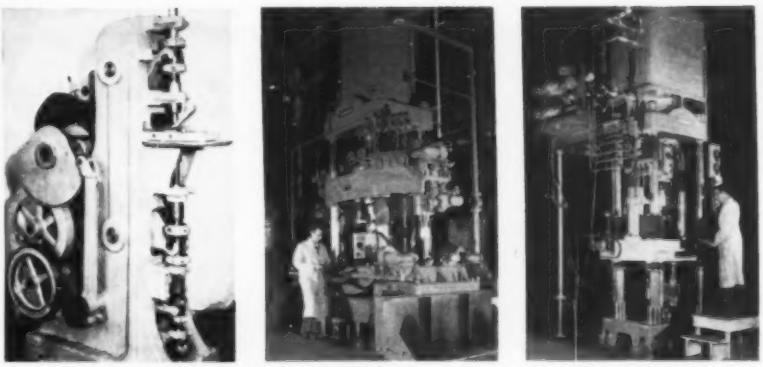
The new re-organization streamlines the powder metallurgy industry. Various functioning groups of MPI can now work together, helping user-industries improve their products by using powder-metal components.

Dr. George A. Roberts is the newly elected president of MPI. He is Vice President of Vanadium Alloys Steel Co. Executive Secretary of the MPI is Kempton H. Roll, who will also serve as Administrative Secretary of the four member-associations, and the American Powder Metallurgy Institute.

Presidents of the four trade associations are: E. H. Klein of the New Jersey Zinc Co.; D. L. Almquist, The Stackpole Carbon Co.; C. L. Snyder, General Ceramics Corp.; and R. C. Burgess, Burgess-Norton Mfg. Co.

Father of Powder-Metallurgy, Lawrence Bailey Retires

Lawrence Bailey



BAILEY'S BRAIN CHILDREN, old and young, can be seen as the brood that changes with the times. The press at the left is one of the earliest designed and used in the powder-metallurgy field. An old-timer in the industry will recognize it as one of the first efficient machines of its kind. One of the latest, most dependable, is the 300-ton hydraulic press in the center. Newest series to spring from the mind of the designer is represented by the model at the right. It is a 300-ton capacity, hydraulic, simplified powder-metal compacting press. *(Photos; Press Division, the F. J. Stokes Corp.)*

If one man can be called the "father of powder metallurgy," that man is Lawrence Bailey. Wherever metal powders are pressed, there is Bailey's influence. He built the first press designed specifically for powder metallurgy work and with each new development, his influence is evident.

Mr. Bailey sums up his life's work by saying . . "I went to school and came to work for Stokes." But that could hardly describe the work of a man who has profoundly influenced at least three industries, pharmaceutical, plastics, and powder metallurgy. In these, and other industries, where-ever a Stokes press is used there is evidence of Bailey's genius as a press designer.

Lawrence Bailey graduated from M.I.T. as a chemical engineer in 1915, he received his M. S. degree, also in chemical engineering, in 1916 and in July of that year went to work for the F. J. Stokes Corp., then a manufacturer of tableting and associated equipment for the pharmaceutical industry. With the beginning of powder metallurgy there was a need for presses specially designed for that work and, in the early 1920's, Bailey designed the old "S" press; the first one was installed at Boundbrook Oilless Bearing Co.

As powder metallurgy developed more and more complicated press equipment was needed to make the parts that designers dreamed-up. Bailey met every challenge with a press that would do as much or a little bit more than industry asked for.

Lawrence Bailey's work culminated in the design of two new powder metal presses. One a 300 ton giant that does everything but talk and his final design another

continued on page 50

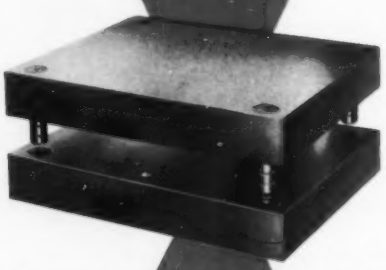
D-M-E STANDARD
Water-Cooled
SPRUE BUSHINGS

DIE CASTERS!

SAVE MONEY ON YOUR DIE CASTING DIES

D-M-E Standards can save you time and money on every die with less initial cost and longer die life.

D-M-E STANDARD
Water-Cooled
SPRUE SPREADERS



D-M-E STANDARD CAVITY RETAINER SETS
Available in Carbon or Alloy Steel

D-M-E STANDARD
Hotform and Nitralloy
EJECTOR PINS

Wide Range of Standard Sizes
from 9⅞" x 8" to 23¼" x 36½".
Standard plate thickness from ⅞" to 5⅛".
Ground flat and square — ready for cavity inserts.

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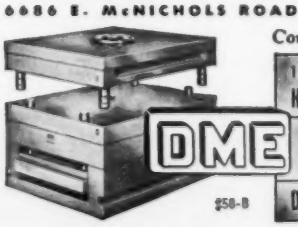
SEVEN BRANCHES TO SERVE YOU.

Write TODAY for Complete Prices and Specifications



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D-M-E OF CANADA	156 NORSEMAN AVE.	TORONTO, ONT.

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PMM OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

MELTING HEAT TREATING
GATING & RISERING METALLOGRAPHY

Engineers experienced in any of these fields can find a secure, challenging, and extremely interesting position with an aggressive, modern, investment casting company located in the East. Please forward complete resume', Box No. 6158.

We need manufacture representatives that are roughly familiar with INVESTMENT CASTING to represent CADMET CORP. in the following areas: PHILADELPHIA, NEW JERSEY, NEW YORK—EAST, MARYLAND, NORTH AND SOUTH CAROLINA, WESTERN PENN., ILLINOIS, INDIANA, ARIZONA, COLORADO. RESUME IN FIRST LETTER TO CADMET CORP. P.O. 4631 MT. ELLIOTT STATION, DETROIT 34, MICH.

EQUIPMENT

SURPLUS FURNACES FOR SALE

IPSEN HEAT TREAT FURNACE model T-100-E complete with panel and 750G endothermic gas generator and 250 CFH exothermic generator used only 6 months.

HEVI-DUTY ELECTRIC BOX FURNACE, type HD 364820 electric door and control panel.

LINDBERG TUBULAR HYDRIZING BOX, type T 367224-HY complete with air-operated door, panel and transformer.

Above items available for immediate delivery — can be inspected in owner's plant — any time! Contact Mr. Archer . . .

ALLOY PRECISION CASTINGS CO.,
3855 West 150th St.,
Cleveland 11, Ohio. CLearwater 2-3650

In the May issue of PMM, the Eaton Mfg. Co. was accidentally omitted as one of the contributors. Our apologies to both the company and to our readers.—Ed.

WHERE PRICES ARE DOWN TO EARTH AND QUALITY AND SERVICE ARE "OUT OF THIS WORLD"

DIE CASTINGS OF ALUMINUM, ZINC, TIN AND LEAD ALLOYS

Your inquiries will receive prompt attention

You may contact our main office and plant or the district office nearest you

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DIE CASTING COMPANY
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LATROBE, PA.

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227 W. Exchange St.
Tel: Portage 2-7663

CLEVELAND, OHIO
William Kranz
19615 West Lake Road
Tel: Edison 1-6888

DAYTON, OHIO
J. M. Gallaher
363 West First St.
Tel: Baldwin 4-3523

DETROIT, MICHIGAN
J. R. Lemen Jr.
1016 Fisher Bldg.
Tel: Trinity 3-5910

PHILADELPHIA, PA.
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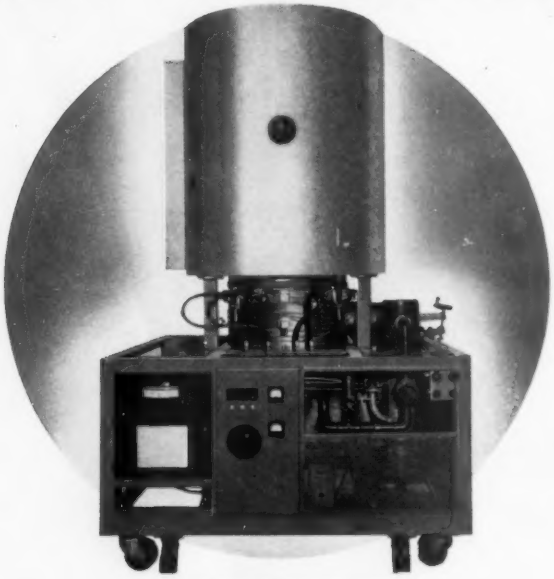
HIGH VACUUM
ANNEALING • SINTERING • WELDING • BRAZING &
HEAT TREATING



Kinney®

HIGH VACUUM FURNACES

The Bell-type Annealing Furnace shown above is but one of many KINNEY High Vacuum Furnaces developed for improved metal treating. From melting, alloying and casting to degassing, sintering, annealing, brazing and welding, KINNEY provides the High Vacuum equipment to meet your special needs for product improvement.

The approach of KINNEY engineers to modern High Vacuum techniques is based upon many more years of Vacuum "know-how." This is reflected not only in the practicality of the equipment but in the economic advantages in design, operation and maintenance, as well. Write for outline of advanced techniques in vacuum heat treating, or better still, make a date to discuss your Vacuum Furnace problems today!

WRITE FOR LITERATURE DESCRIBING NEW DEVELOPMENTS IN HIGH VACUUM EQUIPMENT

KINNEY MFG. DIVISION
THE NEW YORK AIR BRAKE COMPANY
3601F WASHINGTON STREET • BOSTON 30 • MASS.

Please send me your latest literature on KINNEY Heat Treating Equipment ☐ Please have an engineer call me ☐

Name_____

Company_____

Address_____

City_____ Zone____ State_____

For more information circle No. 55 on the Reader Service Card

PMM LETTERS

the readers' forum

LOW TEMP. CASTING

What information is available on casting low temperature alloys—500F and under—in rubber molds? – G. V.

The names of companies experienced in this work have been furnished.—Ed.

MOLD COMPONENTS

Can you tell me of any companies who might be able to supply molded or cast metal cavity linings, to be supported by steel mold bases, suitable for rubber molding:

My company has developed a method of injection molding of elastomers and is seeking a method of reducing the very high machining costs by developing a system of replaceable molded metal inserts in mold bases.

Perhaps you could also suggest sources for such mold bases.—B.E.P.

The desired information has been sent this reader.—Ed.

WHO USES IT?

We are interested in contacting users of ground magnetite concentrates. Can you furnish us with the names of any companies you know of so that we may contact them.—V. McN.

The names of several possible users of ground magnetite have been furnished. However, we do not know of many of the specialty consumers.—Ed.

CAST FILM HOLDERS

We are manufacturers of a new film magazine. At present the frame is of aluminum angle and the main plate is milled from aluminum plate stock. We would like to determine if this product can be cast so the finishing costs would be reduced. Can you suggest any precision molders who might be able to cast this part.—T.J.O., vice pres.

We will be glad to forward the names of any fabricators who feel that they can make this part satisfactorily. Flatness and high precision are, of course, prime requirements.—Ed.

CASTING CONSULTANTS

We are currently developing a new design involving the casting of an aluminum shell around a steel

core. We are interested in determining the casting process and alloy which will give us the best results from the standpoint of quality with the cost factors important, but of secondary interest. At present, we are considering both die casting, some of which we do ourselves, and permanent mold casting.

Could you give us the names of several consulting services or individual consultants who would be able to make an evaluation of this problem for us.—A.C.W.—vice pres.

Several consultants have been suggested to this reader. We receive many requests for the names of consultants in the precision molding field. While we know of many, it is probable that our list is not complete. Any men in this field who wish to be listed with PMM as consultants need only send us their name and address with the fields in which they specialize. All readers who ask for the names of consultants will then receive the complete list of men who specialize in the field of particular interest.—Ed.

VIBRATING BARRELS

Would you kindly put us in touch with the Elliot Mfg. Co. and Minnesota Mining and Mfg. Co. to send me literature on Vibraslide Barrels as discussed in PRECISION METAL MOLDING for March. W.M.A., as't. mgr.

The addresses have been sent.—Ed.

CHEMICAL MILLING

We were very much interested in the PMM Technical Report on page 54 of the April, 1958 issue which covered Chemical Milling.

We would appreciate additional information on this process:

1. Can this process be used with cast brass, approximately 80% Copper, 7% Lead, balance Zinc?
2. If so, what kind of a finish may be expected after such chemical milling to a depth of about 0.010 to 0.015?
3. Can you furnish the complete address of the U. S. Chemical Milling Corp.?—L. J. Q., works mgr.

This reader has been referred to U. S. Chemical Milling Corp. for answers to the first two questions. The full address has been sent.—Ed.

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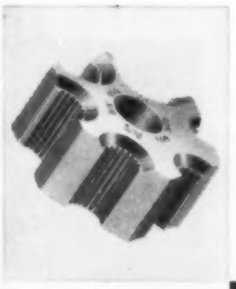

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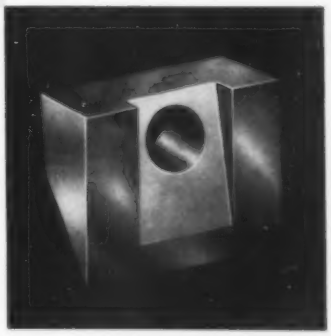

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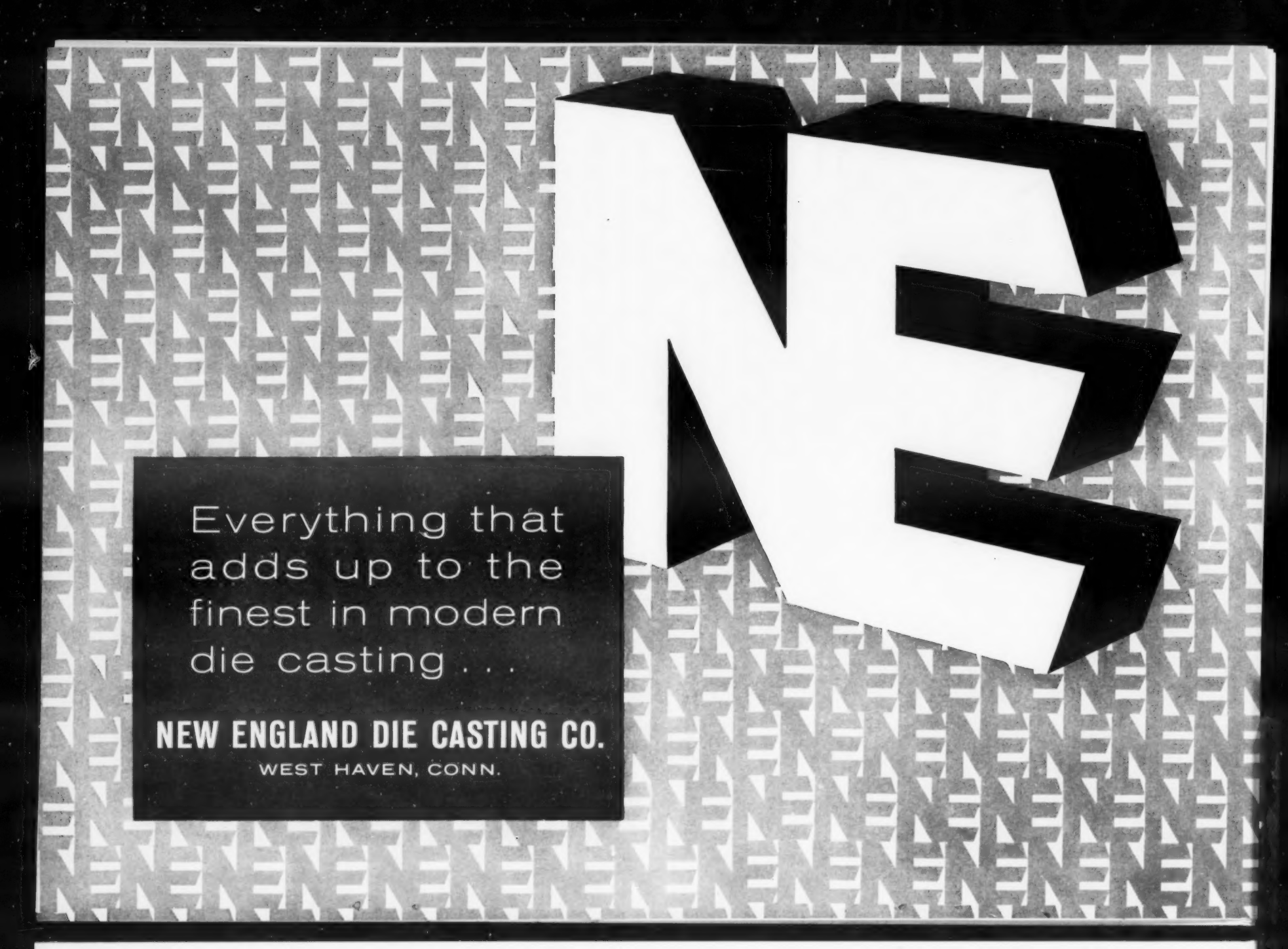
NE
Everything that adds up to the finest in modern die casting . . .
NEW ENGLAND DIE CASTING CO.
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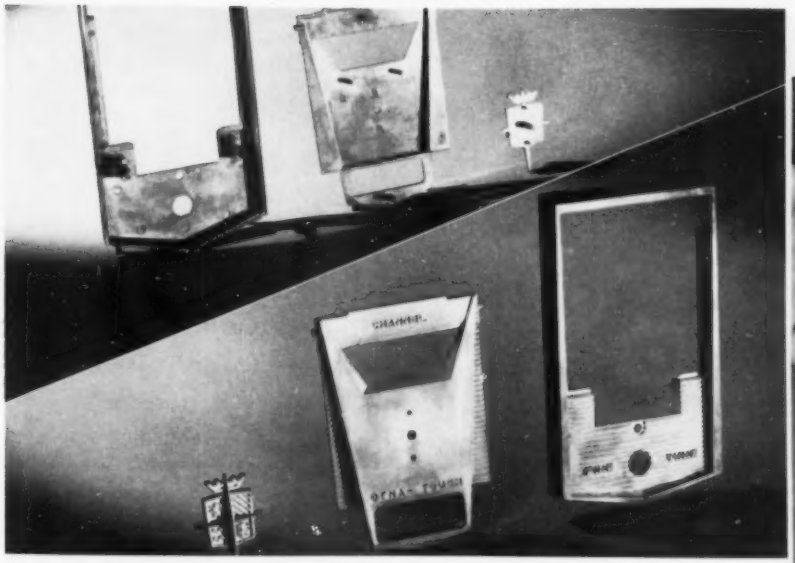
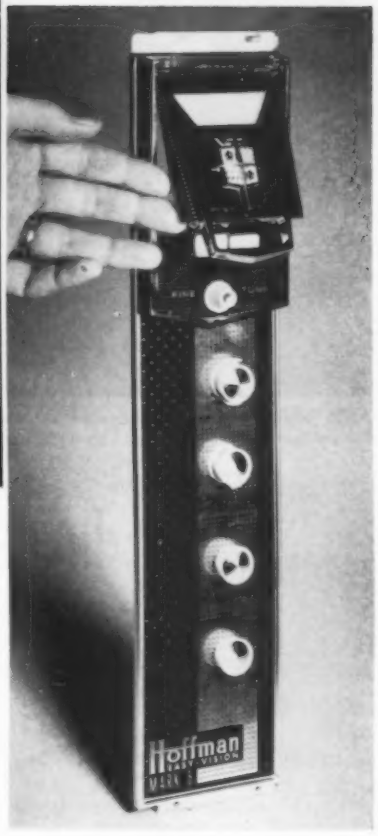




THREE ZINC DIE CASTINGS as they look on arrival before being assembled into escutcheons at Hoffman's plant.

ASSEMBLED DIE CASTINGS are seen here as they look when put together to make up the entire control panel. It should be noted that they blend in with the panel, giving it a pleasant, well-styled, attractive appearance.

TV RECEIVER has escutcheon made of an assembly of three zinc die castings. *(Photos: American Die Casting Inst.)*

For Functional-Decorative Parts, Use Die Castings!

WHEN a part, or group of parts must be functional as well as decorative and structural, several important factors must be kept in mind.

These reasons are both physical and economic.

It was for physical reasons that the first way to make escutcheons for television sets was rejected by the makers of Hoffman TV receivers.

The company's product engineers and designers were first going to specify injection-molded, clear plastic parts. The decorative finish was to be vacuum plated on either the back or front face of the clear plastic escutcheon parts.

But plastic parts were too weak and *did not* have the desired jewelry look and feel.

And it was for economic reasons that they abandoned the second way to make the escutcheons.

They were to be die-formed of sheet metal, but it was *impossible* to get the intricate detail they wanted on the parts.

But added were the additional requirements for such things as mounting pins, hinges, and other necessary features which make *tooling costs prohibitive* for the large number of pieces needed.

After they rejected the possibility of either plastic parts or stampings, Hoffman's engineers tried and tested die castings . . . *successfully!*

Today the entire escutcheon assembly is made up of three zinc die castings.

This trio of zinc die castings is being easily finished at low cost with a combination of enameled and electroplated coatings.

They have the jewelry feel and the strength a functional part needs to do its job, and do it efficiently. Intricate detail is cast into their surfaces but the surface itself is smooth.

The sharp engraving is reproduced faithfully in the finished casting. The cored openings together with the cast projections are made without the necessity of a machining operation.

Hoffman engineers give a lot of the credit to their supplier of the zinc die castings. They made it a policy to take his advice on product design.

And this is the policy that led to specifying shapes and tolerances that meet requirements of function and appearance. . . . Features within range of economical die casting methods.

WAXES which have been prepared for use in casting parts made by the Plyshell process. The wide variety of shapes and sizes which are made by this process can be visualized by examining these interesting, precision-made wax-pattern forms.

NO SUPPORTS held the mold which made this 14", 33 pound textile machine part.

Investment Casting In Europe

By H. J. MARSHALL

INVESTMENT casting was introduced into continental Europe in 1946. The Austenal process was adopted because it was fully engineered and did not require ethyl silicate as a binder.

By 1951 eleven firms had been licensed to manufacture under Austenal patents. Today these firms pour 80% to 90% of the investment castings made in Western Europe. All of these companies are large, for example one produces from 500,000 to 750,000 machine components per month.

Other investment casting processes have been introduced, but all of these are on a much smaller scale than the Austenal process. Investment casting is an important and stable part of the European foundry business.

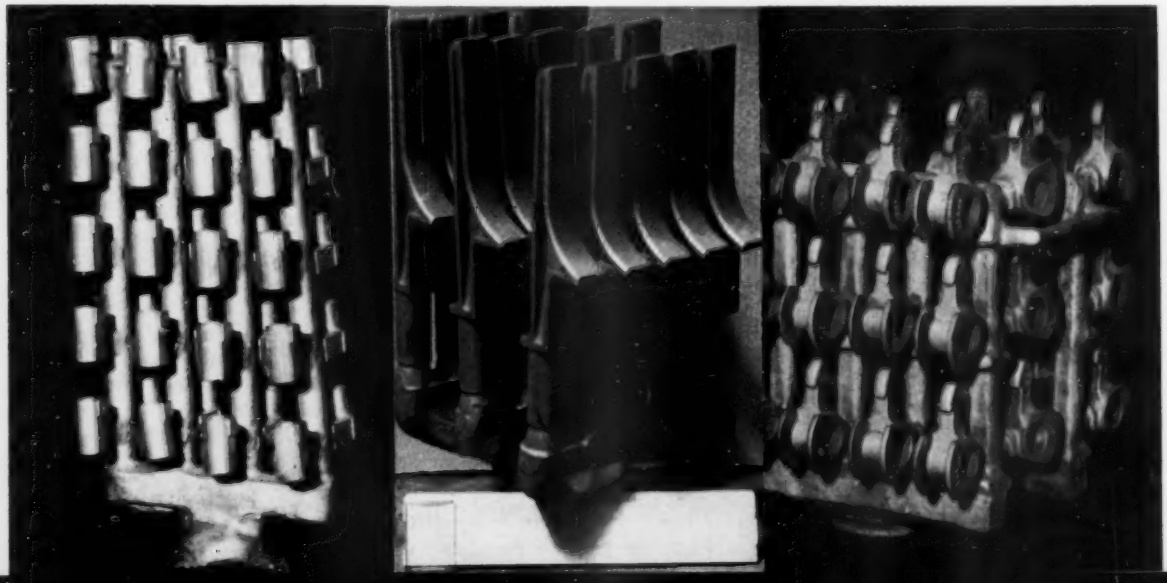
One important way in which continental European useage differs from both the United States and Great Britain is that aircraft components are a small part of the total production. The investment casting of aircraft components has not been able to compete with other methods of fabrication. In France, Belgium, Sweden, and Switzerland a very few aircraft parts are investment cast. In other Western European countries the number made is insignificant.

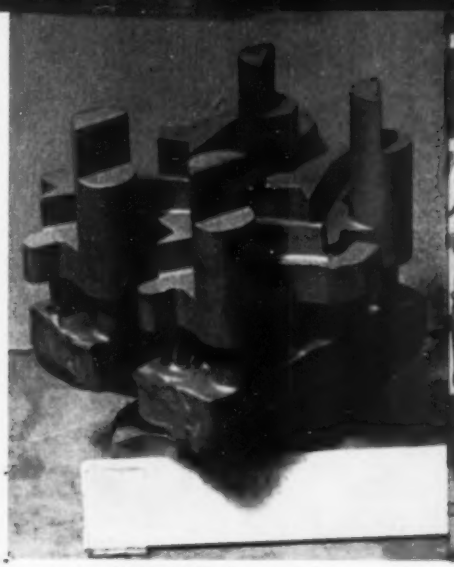
With low labor rates, machine parts can be made by older methods very cheaply. Investment casting must compete with these methods. The need for mechanization of the investment casting foundries

PLYSHELL castings from the mold.

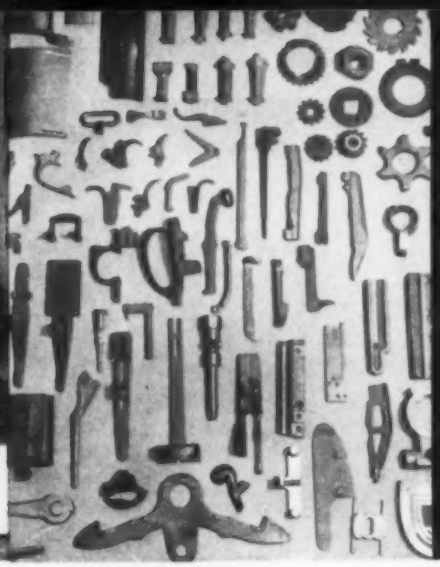
CAST cluster as they are molded.

AS CAST cluster from a Plyshell.

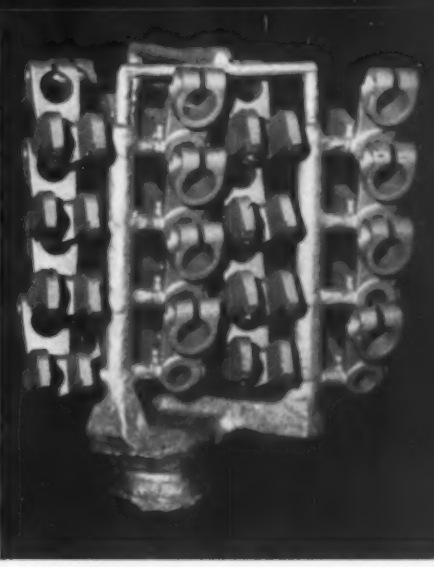




INTRICATE shapes of this group of parts is seen in this picture.



AUSTENAL-PROCESS-made pieces seen here are made in Western Europe.



PLYSHELL molds produce a variety of castings with precision.

is great. One step toward mechanization is the development of the Plyshell Investment Casting Process.

Plyshell is a shell mold built up over a wax or plastic pattern. Molds of this type have been used in both Great Britain and the United States under the names of Glasscast, Monoshell, Mercast, and Investment X. The most important ways that Plyshell differs from these other methods are: low cost, rapid cycle, and the possibility of mechanization.

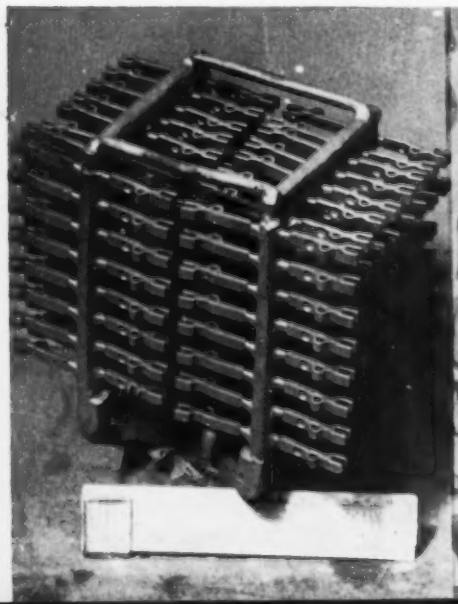
The Plyshell mold is composed of a built up ceramic shell about ¼" to ⅜" thick. The shell is built up in successive layers. It is highly porous, requires no external support during casting, and withstands ferro-static pressure very well. The largest part that has been cast up to now, weighs 33 pounds and was cast directly into a Plyshell mold without any support at all.

The average material cost for molds of the type illustrated is less than seven cents each. The molds are made by dipping the wax or plastic patterns into refractory slurries. Drying is not required between successive dips. Using hand methods, a Plyshell mold is made in sixteen minutes. With very simple machines the time is eight minutes. When fully automatic machines are used the total time from the pattern, ready for dipping, to a mold ready for dewaxing is 24 minutes.

The refractory slurries are stable and do not require agitation. After dewaxing, the molds may be stored indefinitely. Preheating before pouring does not require the slow heat-up and long soak that regular investment casting molds need. The shells are taken from storage and placed directly in a hot furnace. From fifty to seventy minutes in the furnace is adequate.

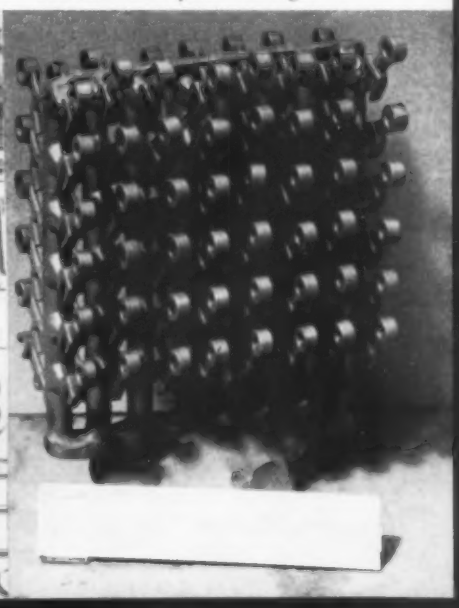
Most pouring is by gravity, but pressure, vacuum or centrifugal casting can be done when desirable. Air elimination is through the porous mold structure. It is only necessary to provide an adequate head of metal to fill the mold completely and to feed during solidification of the casting.

The rapid and uniform dissipation of heat during metal solidification is one of the major advantages of the Plyshell method.

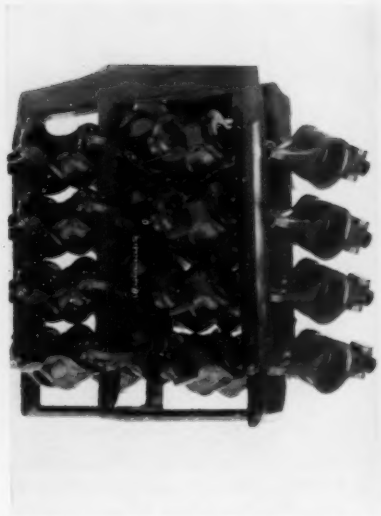


CLUSTER made in Plyshell molds.

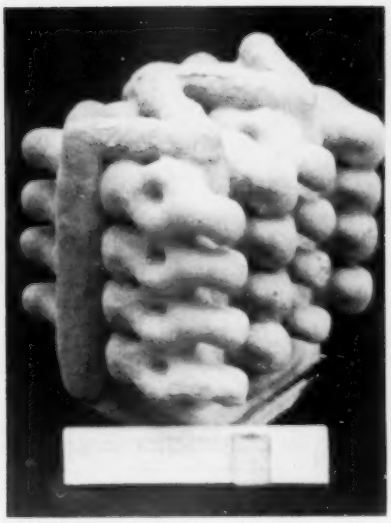
PARTS made by Austenal process.



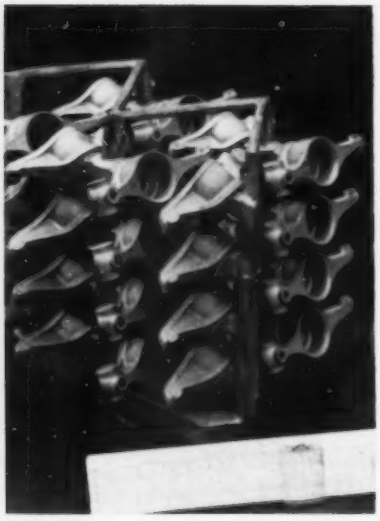
CLUSTER of Plyshell castings.



WAX PATTERN ready for investing with plyshell material.



PLYSHELL MOLD after dewaxing, ready for casting.



CASTINGS made in an unsupported plyshell mold.

While some of the clusters illustrated are of closely packed parts, the trend is to greater separation to insure more uniform refractory thickness and more uniform heat dissipation.

The following steels have been cast successfully in Plyshell molds: low and medium carbon steels, low alloy steels, nickel chromium and chromium molybdenum steels, 13% chromium with carbon varying from 0.10% to 1.90%, 18-8 types of stainless steel, 25-20 type refractory steels and Monel metal. With the experience gained in casting these materials there should be no difficulty in casting non-ferrous metals.

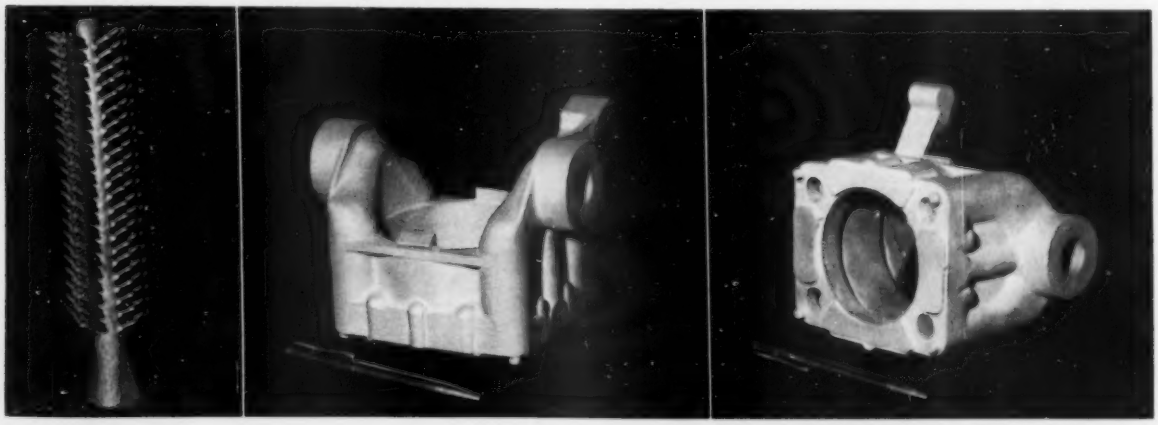
Tolerance variations from casting to casting seem less in Plyshells than in conventional investment molds. This is probably due to the more uniform rate of solidification and cooling. On complicated castings that show a high reject rate when cast in conventional investment molds, a 50% to 60% reduction in the number of rejects is normally found when a Plyshell mold is used.

Evidence indicates that the lower reject rate is due entirely to the mold. Angles are sharp, surfaces smooth, small cored holes properly formed and complicated coring faithfully reproduced. The fact that the mold is porous and thus prevents entrapment of air and the total absence of mold wash are probably the major contributing improvements.

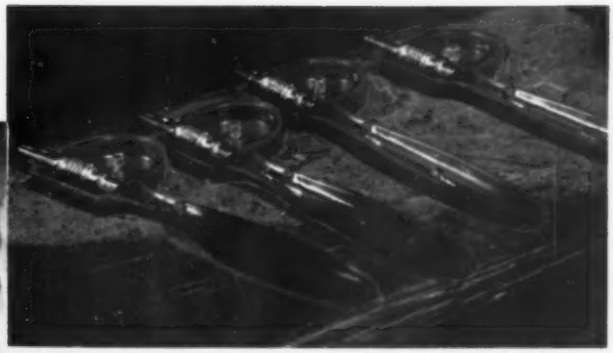
In addition to the low mold costs and the fewer rejected castings, this new type of mold shows other cost savings. The amount of heat required during pre-heat is considerably less, productivity per man is increased due to the decreased weight of the molds. Clean-up is faster and no metal flasks are needed. There is some evidence, though not proven yet, that lower pouring temperatures can be used. With the development of automatic mold making equipment, the cost of castings made in Plyshells should be considerably below the cost of castings made in conventional investment molds.

Full details concerning mold materials, binders, etc. will be published in the near future when the patent situation has been completely clarified.

LARGE OR SMALL parts are made equally easily by investment casting. When size is not limited by a steel flask the individual part, or the cluster can be as large as may be desired.



AS-CAST gears have numbered counter-dials put on.



WORM GEARS already in place inside the hollow handles.

DIE CAST GEAR ready for use.

LOOP on worm replaces wire.

When lightness and strength are needed most . . .

Die Cast Gears Succeed Where Others Fail!

ASSIGNMENT

Design a counting mechanism that will add up the number of times a child jumps over a jumping rope. Keep it strong and durable, yet low enough in cost to use in a toy priced at a dollar.

Engineers at the Pressman Toy Corporation did it.

No other jumping rope has a counter which totals the skips. Installed in the handle of the rope, it was to be the most appealing feature of the toy. Designing it was a problem in economy, light-weight, strength, extreme compactness, and close tolerances.

The mechanism designed was quite simple. It was a low-gear-ratio worm-gear assembly. The gear turns once with every 48 turns of the worm-gear. Finding the right material for the gear was difficult.

A few materials were picked from a variety of possibilities.

These were put through a series of tests before they were considered for making the gears. There were discouraging failures.

FAILURE I

The parts were stamped from sheet metal, then assembled into one unit. But hand assembly and brazing operations were too expensive. Using them made the total cost too high and hurt sales.

And so the firm's engineers began checking into other materials. They went outside the field of metals and decided to find out what would happen if the parts were precision-made in a non-metallic material.

FAILURE II

Next, the gear and the worm were molded of plastic in Pressman's plastic-injection molding machines. This was abandoned when it was found that multi-cavity molds were needed. They were too costly.

SUCCESS

. . . It came at last.

Why? Because Pressman's designers did not give up after two setbacks. Instead they turned to an unexplored process as a final choice.

Die casting the gear and worm in zinc proved to be the answer to the problem because:

- Eliminating the assembly saved 50%.
- A hoop cast in the end of the worm-gear replaced a wire loop once riveted to the worm-end.
- Number of worm-gear teeth was reduced from 10 to 5.
- Close tolerances held on the die-cast gear are +.000″ to —.004″.
- Parts are used as-cast without finishing.
- Gear is a standard stock part from Gries Reproducer Corp., thus no tooling costs were needed for new dies.

TABLE I

COMMERCIAL FOUNDRY TOLERANCES AND DIMENSIONS FOR LOWEST COST PRODUCTION

Linear dimensions within a mold half — ±0.015 in./in. for the first six inches, ±0.002 in. for each additional inch.
Linear dimensions across a parting line — ±0.015 in./in.
Minimum fillet radius (see fig. 1) — ⅛ in.
Minimum outside corner radius (see fig. 2) — ¼ in.
Minimum ratio of O.D. to I.D. on bosses (see fig. 6) for:
Cored holes . . . . . 3 to 1
Drilled holes . . . . . 3 to 1
Recommended ratio of O.D. to height of bosses (see fig. 3) — 2 to 1
Minimum diameter of free standing posts (see fig. 8) — ½ in. plus draft.

For Rigid Metal Cores
Dimensional tolerances — ±0.010 in.
Ratio of length to effective diameter — 3 to 1
Best commercial surface finish — 125 microinches RMS

For Baked Sand Cores
Dimensional tolerances — ±1/32 in.
Ratio of length to effective diameter — 1½ to 1
Best commercial finish — 250 microinches RMS

For Plaster Cores
Dimensional tolerances — ±0.005 in. on cores under 1 in.
±0.002 in./in. additional above 1 in.
Ratio of length to effective diameter — 1½ to 1 with minimum of ½ in. diameter.
Best commercial finish — 63 microinches RMS.

For Shell Molded Cores
Dimensional tolerances — ±0.010
Ratio of length to effective diameter — 2 to 1
Best Commercial Finish — 125 microinches RMS

On blind holes the ratio of depth to diameter (see fig. 5) — 2 to 1
On Tee sections the recommended ratio of depth to thickness (see fig. 4) — 1 to 2
Average commercial surface finish — 125 microinches RMS.
On flat surfaces that must be webbed to hold flatness or to give adequate stiffness (see fig. 7).
The minimum number of webs to hold flatness to 0.005 TIR is — 4
The minimum web width (w) to hold flatness to 0.005 TIR is — 3/16 in.
The minimum depth (d) to hold flatness to 0.005 TIR is — ½ in.
For general stiffening of flat surfaces the ratio of thickness (t) to:
Number of webs is — 1 to 4
Width (w) of webs is — 1 to 1½
Depth (d) of webs — 1 to 1

Designing For Aluminum Permanent Mold Casting

Part III - Tolerances

One of the reasons for the use of any precision casting method is to eliminate, or lessen, machine work to complete the part. The reduction in machine work is only possible because the different precision casting methods can hold dimensional and surface tolerances that are much closer than those held by sand casting methods.

With any casting method, there are definite limits to tolerances. The designer must work within these limits if he is to secure parts at the lowest cost for the process used. If tolerances are set too broad, it may be that the wrong process is being used. This can represent a dollar waste in both tooling and in production. If tolerances are set too close, costs will always rise. Tooling will be more expensive, production rates will decline, and the percentage of useable castings will go down. All of these factors lead to increased piece costs.

To get the most accurate casting at the lowest possible cost, the designer must know the limits within which he should work. In most permanent mold foundries two different sets of dimensional tolerances and surface finish figures are used. There are the commercial tolerances to which the foundry can work with maximum efficiency and lowest costs. Any tolerances more open than these represents little or no dollar saving and may increase machining costs. The second set of tolerances are the best that the foundry can meet, even at a much higher tooling and piece cost. When the part can stand these higher prices, the tighter tolerances may be justified. Always remember, however, that either dimensional or surface tolerances tighter than these so-called "best" cannot be met at any price.

In the following tables, the standard commercial tolerances are given in Table I and the best possible in Table II. Always work within Table I when possible. Use the figures in Table II only in those few cases where a sufficiently great dollar saving due to lowered

continued on page 50

TABLE II

BEST FOUNDRY TOLERANCES AND DIMENSIONS FOR HIGHER COST PRODUCTION

Linear dimensions within a mold half – ±0.005 in./in. for the first six inches, ±0.001 in. for each additional inch.
Linear dimensions across a parting line – ±0.010 in./in.
Minimum fillet radius (see fig. 1) – 1/64 in.
Minimum outside corner radius (see fig. 2) – 1/64 in.
Minimum ratio of O.D. to I.D. on bosses (see fig. 6) for:

Cored holes.....2 to 1
Drilled holes.....1½ to 1

Recommended ratio of O.D. to height of bosses (see fig. 3) 1 to 1
Minimum diameter of free standing posts (see fig. 8) – 3/16 in. plus draft.

	Dimensional tolerances – ±0.002 in.
	Ratio of length to effective diameter – 10 to 1
For Rigid Metal Cores	Best commercial surface finish – 63 microinches RMS
For Baked Sand Cores	Dimensional tolerances – ±0.010
	Ratio of length to effective diameter – 8 to 1
	Best commercial finish – 200
For Plaster Cores	Dimensional tolerances – ±0.005 in. on cores under 1 in.
	±0.002 in./in. additional above 1 in.
	Ratio of length to effective diameter – 1½ to 1 with m
	Best commercial finish – 63 microinches RMS. inimum of ½ in. diameter.
For Shell Molded Cores	Dimensional tolerances – ±0.005
	Ratio of length to effective diameter – 8 to 1
	Best Commercial finish – 125 microinches RMS

On blind holes the ratio of depth to diameter (see fig. 5) – 4 to 1
On Tee sections the recommended ratio of depth to thickness (see fig. 4) – 1½ to 1
Average commercial surface finish – 63 microinches RMS.
On flat surfaces that must be webbed to hold flatness or to give adequate stiffness (see fig. 7).

The minimum number of webs to held flatness to 0.005 TIR is – 4
The minimum web width (w) to hold flatness to 0.005 TIR is 3/16 in.
The minimum depth (d) to hold flatness to 0.005 TIR is – ⅛ in.
For general stiffening of flat surfaces the ratio of thickness (t) to:

Number of webs is – 1 to 4
Width (w) of webs is – 1.1 to 1
Depth (d) of webs – 1.5 to 1

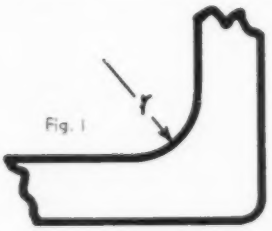


Fig. 1

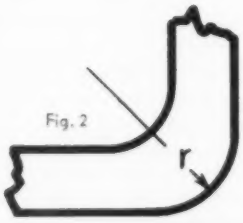


Fig. 2

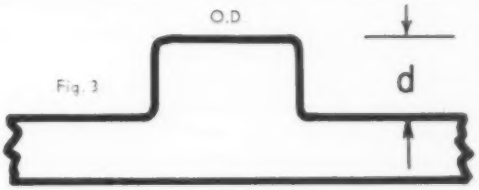


Fig. 3

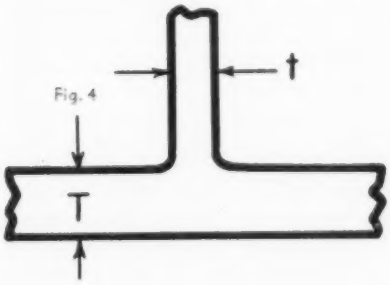


Fig. 4

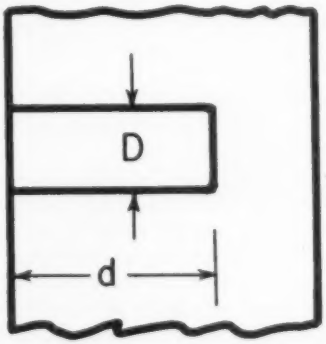


Fig. 5

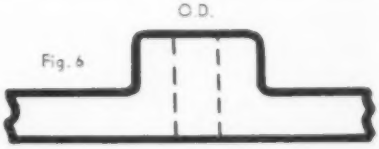


Fig. 6

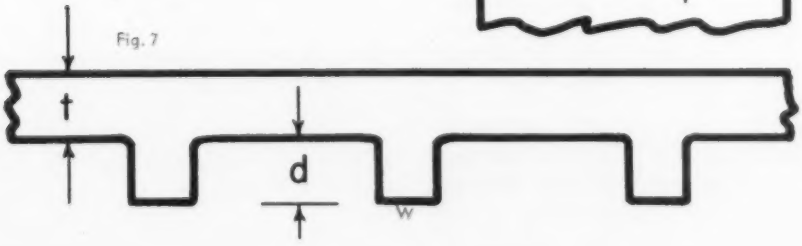


Fig. 7

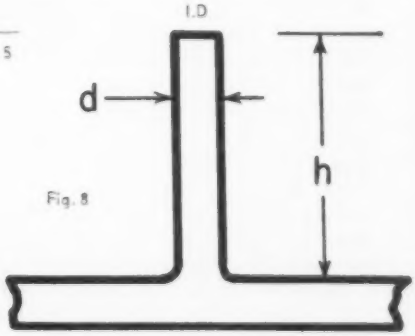
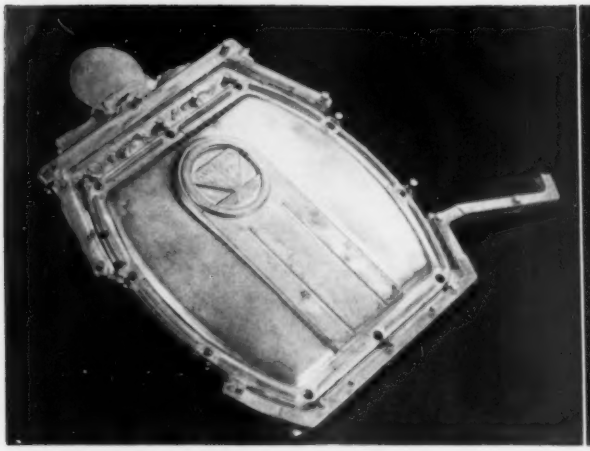
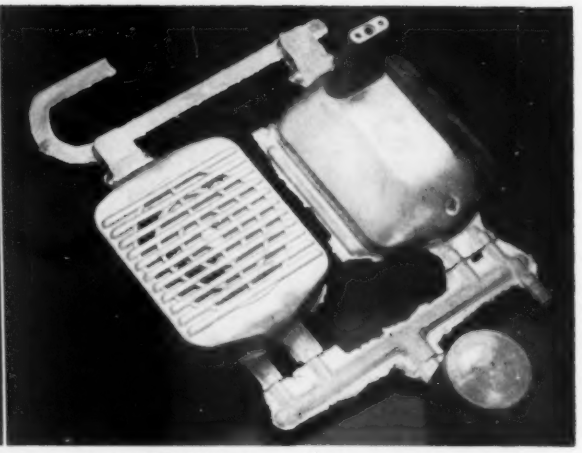


Fig. 8



1. **PRESSURE-TIGHT** die casting is a meter-case.



2. **THIN WALL HOUSING** for outdoor movie-speaker.

When rejects go up or a casting can't be made economically, you may need . . . .

A Vacuum System For Die Casting Aluminum

By G. R. MORTON*

For several years we have been producing a pressure tight aluminum die casting, a part of a gas meter case shown in figure 1. Normal production gave about 5% scrap castings, all leakers. During the summer of 1957, Omaha had exceptionally high relative humidity. The percentage of porous castings immediately rose to over 60%. Degassing the metal, change of lubricants, change of metal and die temperatures and many other variations were tried to overcome the troubles, none of them worked. Finally a system of evacuating the die cavity was tried. The results were immediate and startling. Leakers dropped with the first attempts and, as the vacuum system was improved, the percentage of rejected castings continued to go down. When the vacuum casting system was perfected the meter case castings were made with less than ½% rejects due to porosity.

There are other advantages with vacuum die casting. Reproduction of detail is greatly improved, surface finish is better, thinner wall sections can be cast, and alloys normally sluggish can be cast easily.

The many advantages that vacuum die casting can give are shown in another casting in figure 2. This part is a housing used for outdoor movie speakers. There is good reproduction of detail and the excellent surface finish.

The question now is, how does this vacuum system work and how much does it cost?

Figures 3 and 4 show the basic parts of the system (the pump and reservoir are not shown). A channel, at the parting line, connects the vacuum system to the die cavity. A solenoid actuated valve (H) controls the evacuation of the die cavity and the shot sleeve. In addition an overflow protection device (F) is provided.

Operation can best be understood by a casting cycle. The dies are closed and locked normally. The operator then ladles aluminum into the shot cylinder. When the shot button is pressed, the piston moves forward and at the instant the pouring hole is closed the main vacuum valve (H) opens. Rate of air removal is so rapid that the entire die cavity and the shot sleeve are evacuated before any metal seals off the orifice. As injection continues the die cavity is completely filled and metal starts into the vacuum channel.

To prevent any metal from entering the valve a shut-off cylinder (F) is provided. This cylinder is tied into the hydraulic system of the machine in the accumulator circuit. This allows very rapid shut off of the vacuum channel at any predetermined hydraulic pressure.

There is always danger that there may be a slight excess of metal or that the channel shut-off may fail. To prevent metal passing into the vacuum system an overflow is provided as shown in figure 4 (S). Nor-

continued on page 32

*Owner, Morton Mfg. Co.
Omaha, Nebraska

Die Castings Cut 10 Pounds off Frameweight of New Royal Standard

CASE HISTORIES FROM MT. VERNON FILES . . .

"Never before has a standard typewriter featured so many new improvements. From Twin-Pak to Touch, this new Royal Standard opens up a whole new world of breathtaking ease and economy." It is a fine example of beautiful design, excellent engineering and wise choice of materials.

Because of the remarkable strides made by the die casting industry in the production of sound economical aluminum die castings, the major portion of the framework of all the Royal Typewriters are die cast. Through the use of aluminum die castings having cored holes, close tolerances and thin walls ribbed for maximum strength, Royal engineers have reduced the weight of the framework of the Standard model from 15 pounds to approximately 5 pounds . . . an impressive savings of 10 pounds.

All told, the Royal McBee Corporation uses from 2½ to 3 million pounds of aluminum die castings yearly and the end of die casting usage is not in sight. Royal engineers are constantly alert to additional die casting applications because of the tremendous savings in man and machine hours which are achieved through the elimination of costly secondary operations.

A switch to die casting may be *your* next step. It will be well worth your time to bring your product specifications to Mt. Vernon, for ours is a complete, four-fold service of 1. Consultation 2. Die making 3. Die casting 4. and Machining facilities all under one roof occupying 200,000 square feet of space . . . For quick action, contact your nearest sales representative listed below.

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DIE CASTING CORP.
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GUILDERLAND, N. Y.: Mr. David H. King, 75 Willow St.
LUTHERVILLE, MD.: Mr. C. McIntosh Gordon, Mays Chapel Rd.
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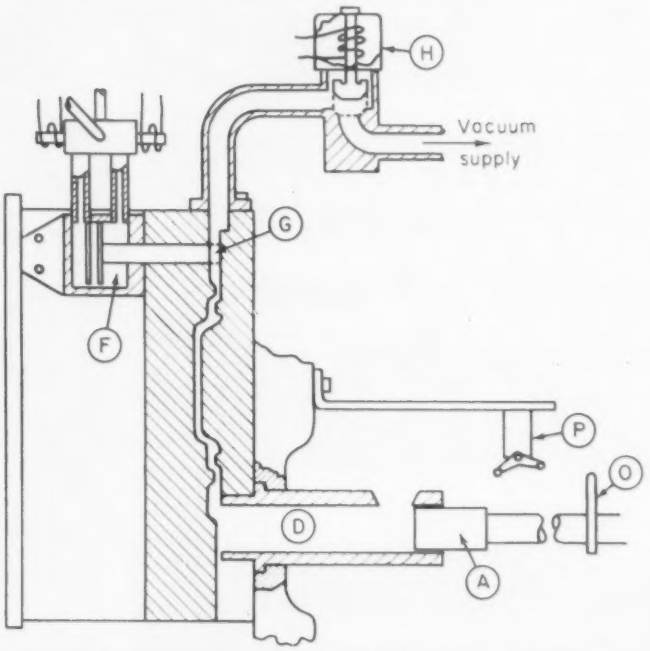
VACUUM / *continued from page 30*



3. THE VACUUM SYSTEM shown schematically. (H) is the main vacuum valve; (F) an auxiliary valve to prevent metal flow to the main valve; (G) the vacuum channel.

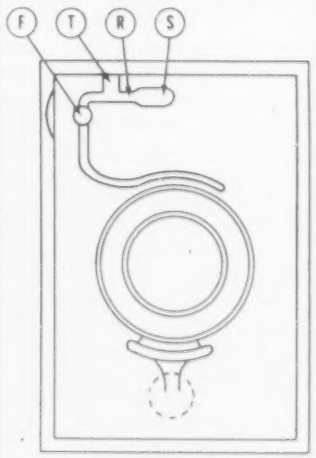
mally any metal will follow a straight line path rather than turn and go into the vacuum line (T). This overflow reservoir is always placed on the parting line of the die so that it is easily emptied if overflow should occur. The main vacuum valve is closed as soon as the shot is completed and before the machine opens.

Our vacuum system is set-up to accommodate three die casting machines. The pump, reservoir and piping have a total capacity of 21 cu. ft. and a 1½ HP motor is adequate to operate the vacuum pump. Under all conditions tested, it is possible to secure a vacuum of about 90% of barometric pressure.

The estimated cost of converting any existing cold chamber machine to this vacuum system is about $2000.00 plus about $300.00 for die modification. Very few changes are made on any die casting machine and these are mostly wiring changes.

Any existing die, if it is in good condition, can be modified at nominal cost by simply providing the vacuum channel, overflow reservoir and outlet. Any overflows and vents on old dies can be left, but on new dies built for vacuum operation they are not necessary.

With well made dies that are kept in good condition, gasketing between the die halves is not necessary. Normal lubrication on core rods prevents leakage.



4. AN OVERFLOW reservoir (S) prevents metal entry into the vacuum valve.

Your source for quality controlled aluminum die-casting metals. Federated aluminum ingot production is under rigid controls developed by Asarco's Central Research Laboratory. Federated Sales Engineers back up every shipment with on-the-spot assistance based on long detailed experience. For a complete choice of both aluminum and zinc die-casting alloys, call any one of the 11 plants and 23 sales offices of Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

SINTERINGS

Powdered Bronze Carries A Heavy Payload

TOUGH, ROUGH EQUIPMENT such as is seen working hard in the above photograph can be depended on to operate efficiently and with little maintenance. Credit for this goes to the use of sintered bronze, Oilite bearings which are lubricated for life before installation. They need no other lubrication.

SELF-LUBRICATING sintered bearings are giving years of low-cost, maintenance-free service on some of the most rugged equipment ever developed. For example, they are being used on the rubber-tired trailers made by the Athay Products Corp., in Chicago, Ill.

One way this firm gets rugged performance is by using Amplex Oilite bearings.

These heavy-duty, oil cushioned, powdered bronze bearings have proven to be more than a match for the 22-ton and 34-ton payloads carried on the company's trailers.

They are used for heavy-duty handling on construction jobs all over the world. They must be able to withstand brutal shock without breaking down.

In addition to carrying the load on these trailers, the bearings must absorb loading-shocks and impacts.

PICTURED ABOVE IS OUR MODERN SHOP AND OFFICES

exclusively devoted to engineering and building die casting dies and molds to exacting specifications. This plant was designed with capacities to handle and fabricate anything from a unit die insert to a 15 ton cylinder or grille die with the necessary skills and experience to save you time and money on your next tool.

RICHARD O. SCHULZ CO.

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DIE CASTING DIES • PLASTIC INJECTION AND COMPRESSION MOLDS

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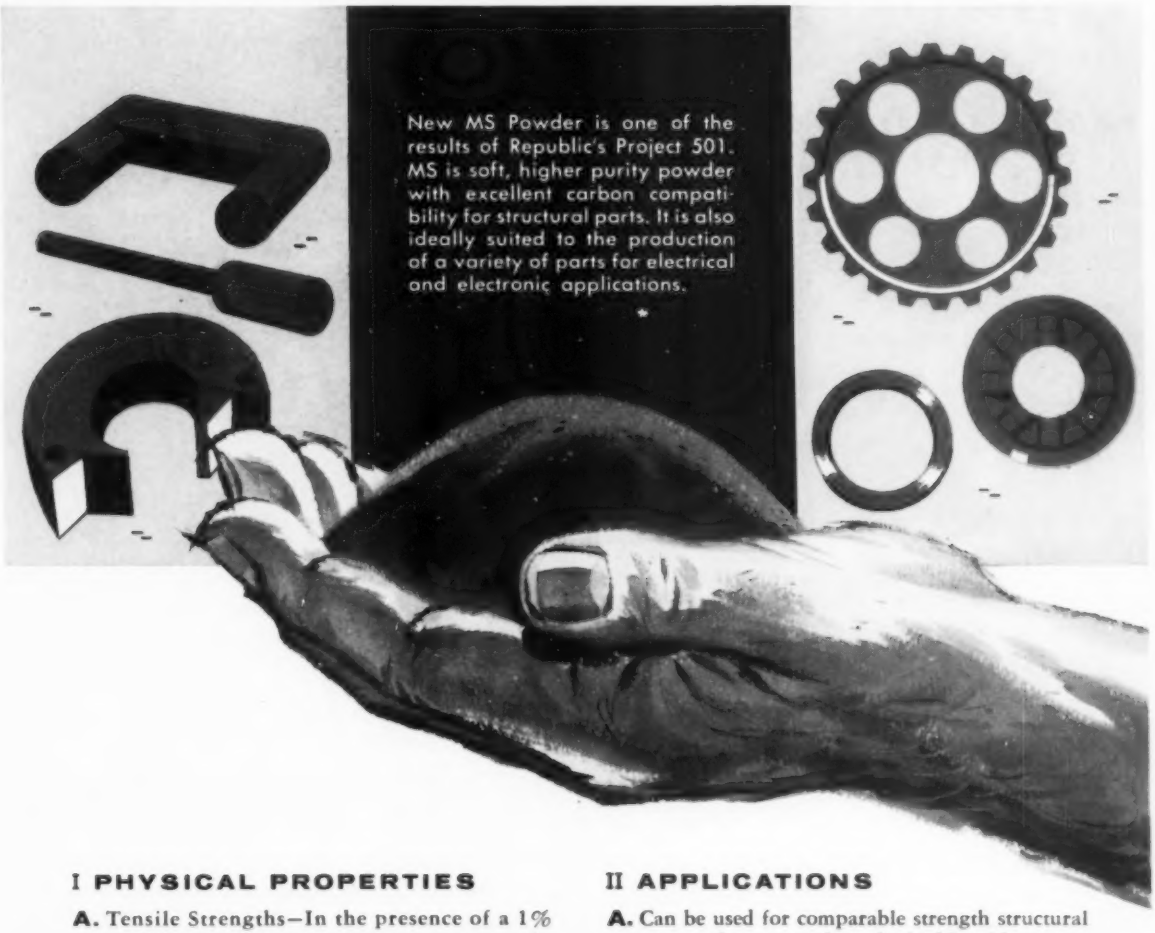
Republic Steel Develops NEW MS POWDER


New MS Powder is one of the results of Republic's Project 501. MS is soft, higher purity powder with excellent carbon compatibility for structural parts. It is also ideally suited to the production of a variety of parts for electrical and electronic applications.

I PHYSICAL PROPERTIES

A. Tensile Strengths—In the presence of a 1% graphitic condition, physical properties can be obtained ranging from 42,000 psi at 6.1 sintered density to 53,000 psi at 6.5 sintered density.

B. Compressibility—

Briquetting Pressures	Green Density
20 tons at 6.0	
30 tons at 6.4	
40 tons at 6.65	
50 tons at 6.8	

C. Dimensional Change—From —.001 inches per inch at a 5.95 green density to a +.002 at 6.7 green density.

D. These values obtained by sintering in an Endo Thermic Atmosphere: air-gas ratio 2.5 to 1; dew point +10° to 13°F; 2030°F; 45 minutes at heat.

II APPLICATIONS

A. Can be used for comparable strength structural parts at *lower cost* than obtainable with copper. Savings are achieved by using 1% graphite as against 7-10% copper addition required with comparable powders.

B. Ideally suited for use in electrical part and electric motor applications—pole pieces, permanent magnets, cores, armatures, etc.

C. Can be used to fabricate larger parts on normal pressing equipment. MS Powder's softness makes this fabricator benefit possible.

Write Dept. PM-5980, 1441 Republic Building, Cleveland 1, Ohio, for complete information on chemical composition, physical properties, and test evaluations. Republic Powder Metallurgists and Engineers are always available to help you without obligation.

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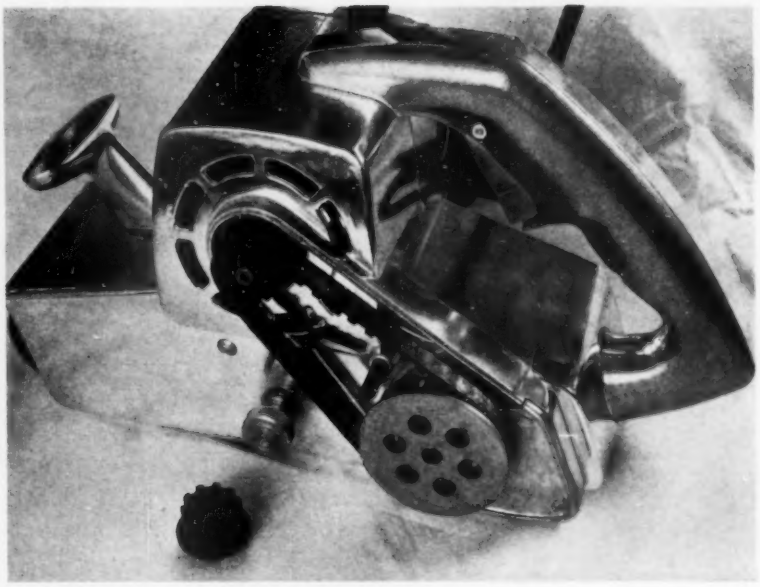


EXCELLENT WEARING CHARACTERISTICS make these sintered iron pullys extremely useful as a cost cutting item. Added advantage is the fact that sintered parts are also of higher quality than the machined pulleys used earlier.

You Can Reduce Machining and Cut Costs with Sintered Parts

DIE-PRESSING mechancial parts directly into finished shapes requires very little machining, sometimes none at all. Because of this, Amplex sinterings are helping many manufacturers hold down rising production and fabrication costs of their products.

By replacing machined parts with sinterings, it may be possible to cut costs as much as 80%. A good example of the advantages is found at the Stanley Electric Tool Division of the Stanley Tool Works in New Britain, Conn.

Here is what happened.

This company put two new electric sanders on the market. One, a heavy-duty belt-sander, is designed for professionals. The second, a more economical, orbital-sander, is made for amatuer woodworkers and most of the do-it-yourself experts, including hobbiests.

Both sanders are belt-driven and equipped with two sintered pulleys. The parts, seen in the picture above, were developed by Amplex engineers working with Stanley.

The specifications demanded a hard-coated, rust-resistant drive-pulley with positive action.

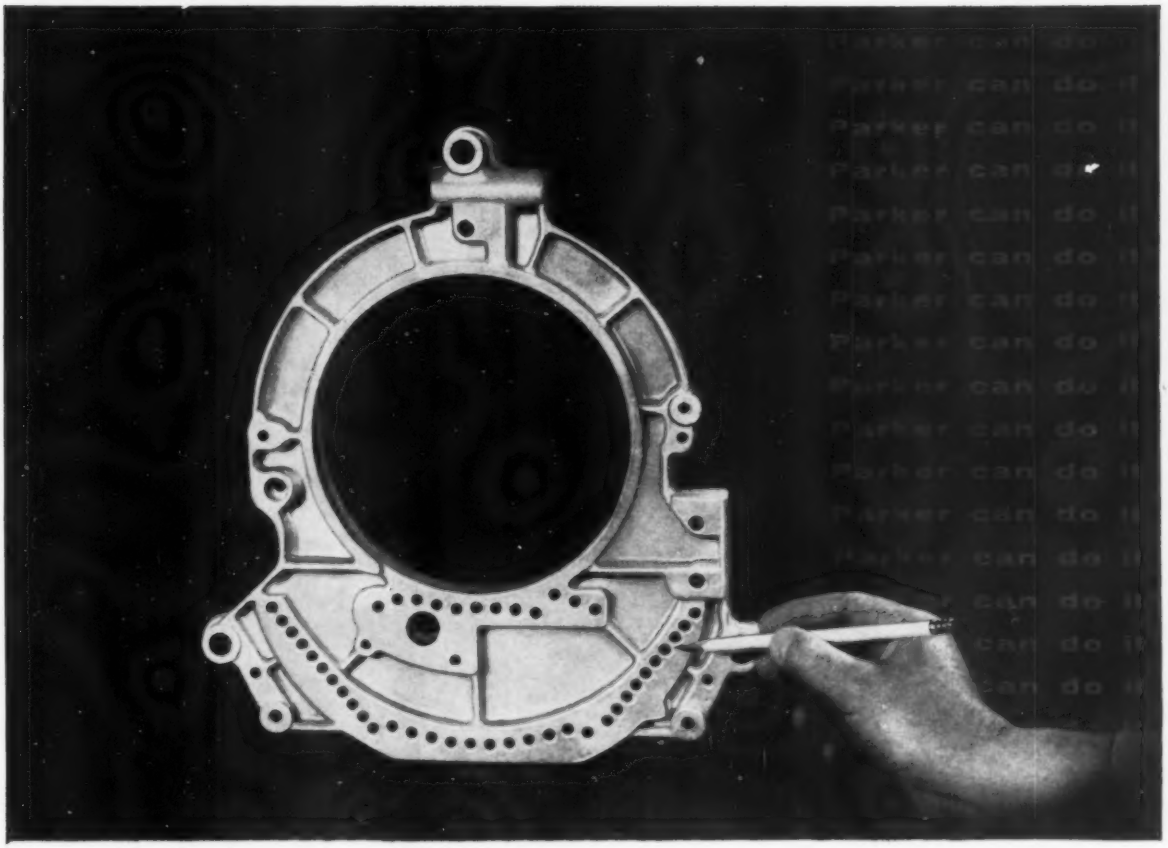
And it had to be easily machined.

Sintered iron Oilite filled the bill . . . perfectly.

By holding close tolerances, no machining has to be done except a tapping operation on the center hole.

The result of this development was a maximum saving.

The Stanley Co. chose to use sinterings because of the part's proven economy and excellent wear-resistance.



The WHOLE Story Of Die Casting Savings

These close tolerance holes could have cost more than the part itself. Actually, *they cost practically nothing!* Parker-engineered die casting makes the difference. By means of precision coring, the holes are cast to exact diameter and location . . . a bonus in the low unit cost of producing the complete part. Just think of the savings compared with other production methods requiring finish machining.

The creative engineering approach that made these savings possible has been the hallmark of Parker service since 1906. It is the plus factor that is never figured into a Parker estimate. If you are a Parker customer, you know this is so. If you are not, you can profitably prove it to yourself by consulting the nearest Parker sales engineer on your next component part requirement.

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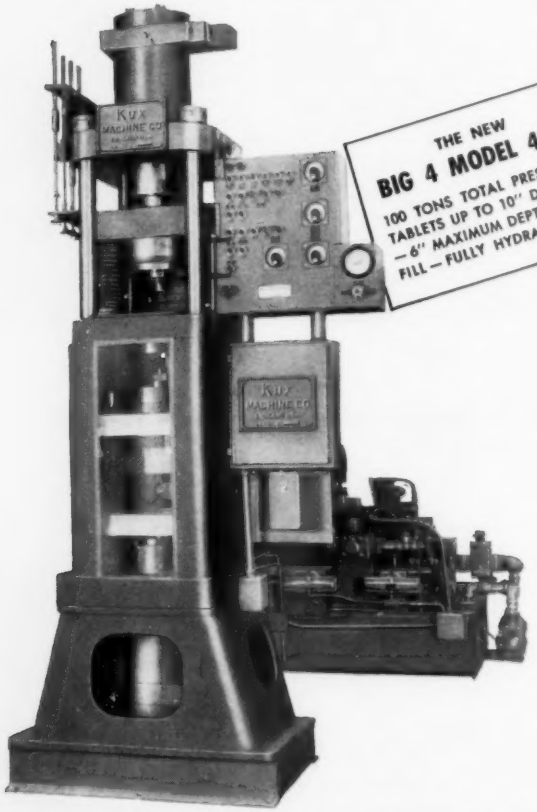
An entire range of sizes and models, both mechanically and hydraulically operated is available in the Kux family of powder metal presses, a few of which are illustrated. A card will bring you an illustrated catalog of these famous machines which set the standards for peak performance.



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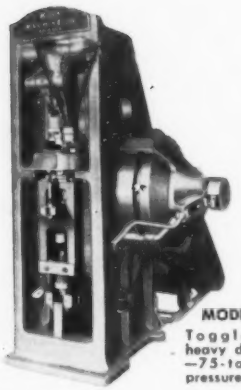
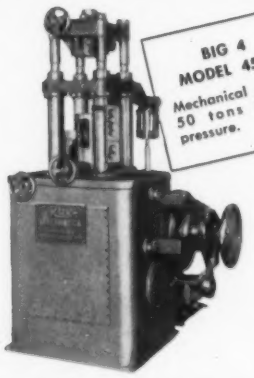
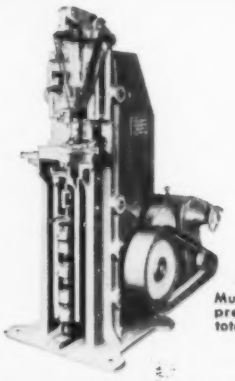
BIG 4 MODEL 4100
100 TONS TOTAL PRESSURE — TABLETS UP TO 10" DIAMETER — 6" MAXIMUM DEPTH OF DIE FILL — FULLY HYDRAULIC



MODEL 65B
Toggle type heavy duty press —75-ton total pressure.



BIG 4
MODEL 450B
Mechanical press 50 tons total pressure.



MODEL 64
Multiple motion press — 30 tons total pressure.

- **Fully Hydraulic** — applies pressure to tablet with both upper and lower punches. Lower punch ejects tablet with full forming pressure.
- **Completely Automatic** — pushbuttons operate machine continuously or through a single cycle with an automatic stop position.
- **Accurate Dimensional Thickness of Tablets** — upper and lower punches come to a positive mechanical stop position, holding thickness of each tablet.
- **Always True Density** — upper and lower punches can be adjusted to come to a hydraulic pressure stop position, applying exact pressure on the tablet to give true density regardless of variation in die fill.
- **Perfect Punch and Die Alignment** — combination leader-pin, ball-bearing guides keep upper punch in perfect alignment with die at all times, so that close tolerance parts can accurately be made.
- **Push Button Control of Adjustments** — for upper punch penetration into die, and the die fill allows instant and accurate change of either setting, and scales show the exact position of the punches at all times.
- **Independent Secondary Lower Punch Mechanism Available** — hydraulically operated with separate timing and stroke control — can be used to apply pressure, to eject compact, or to move core rod up and down during filling or ejection sequence.

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Also builders of a full range of die casting machines . . . from 25 tons to 1000 tons in size.

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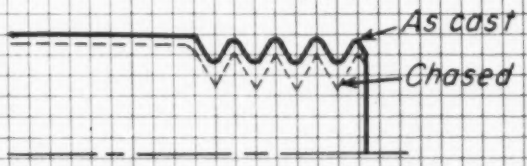
use these

Design Tips

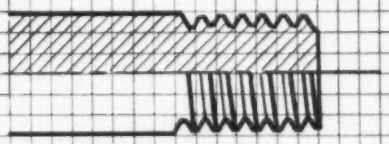
for lower costs
-better products

Use these tips when designing cast threads. Never cast threads unless absolutely necessary. The best fit that can be cast is a Class 1.

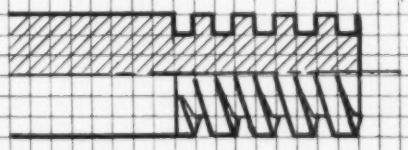
Use rounded threads. Class I fit is best that can be cast. Investment castings in ferrous metals, R_1=0.012"—Non ferrous metals, investment or die cast R_1=0.005"



When thread is chased after casting, allow about 0.005" stock removal.

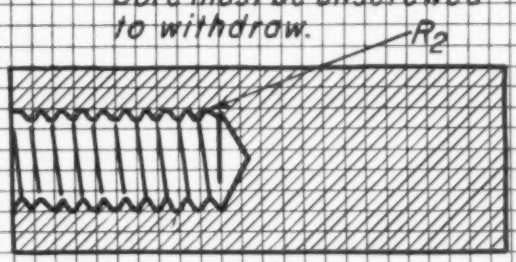


U.S. Standard thread form. Not a good form for casting.

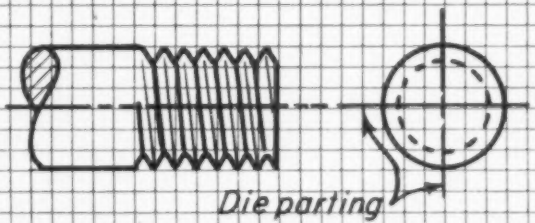


Square thread form. More easily cast, especially on internal threads.

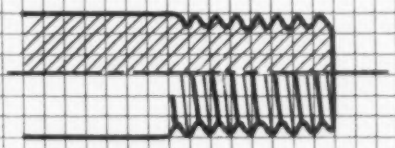
Core must be unscrewed to withdraw.



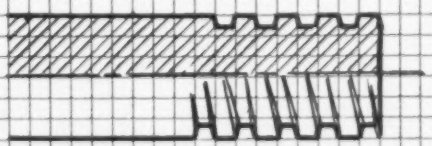
If internal threads must be cast use a well rounded thread. Investment castings in ferrous metals R_2=0.035". Die castings or non ferrous metals R_2=0.020"



On die cast external threads, die parting must be on diameter with half of threaded stud in each die part.



Whitworth thread form. More desirable than U.S.S. form.



Acme thread form. Most easily cast thread.

DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.

2. Induction Furnaces—Equipment with capacities from a few ounces to several tons is described in literature available from Ajax Electrothermic Corporation.

8. Fluxes—for all metal melting industries are presented in technical literature from Atlantic Chemicals & Metals Co.

10. Plunger Rings—of hardened steel give over 100,000 shots per set in many installations. Auto-Diesel Piston Ring Company will supply complete information.

12. Sintered Powder Products—A 24-page engineering handbook offered by Bunting Brass & Bronze Co. describes their sinterings; their manufacture and application.

14. Custom Alloys—An engineering handbook for metallurgists published by Cannon-Muskegon Corp. gives complete data on their "Ultra-Met" and "Mastermet" alloy service.

15. Automatic Loader-Unloader—that loads laminations, die casts, trims and unloads 4 rotors is presented in an illustrated brochure from Castmaster, Inc.

16. Die Casting Machine—Bulletin 600, issued by The Cleveland Automatic Machine Co., describes a 600-ton unit which can be used with a hot chamber shot end or converted to a cold chamber machine if needed.

17. High-Vacuum Pump—Roots type unit provides vapor-free vacuum. Bulletin P8-20, available from Consolidated Electrodynamics Rochester Division, gives complete data on performance and theory of operation, available on request.

18. Anti-Seize Compound—Thred-Gard eliminates seizing and galling of threaded connections and screwed fittings to temperatures of 1200°F. Literature is available from Crane Packing Co.

20. Sprue Bushings—sprue spreaders, ejector pins and cavity retainer sets are described in literature from Detroit Mold Engineering Co. Includes complete prices and specifications.

22. Die Profiler—Price List DV-68 describes a flexible shaft reciprocating tool for grinding, filing, scraping, honing, lapping and polishing. Engis Equipment Co.

25. Small Die Castings—An informative bulletin published by Gries Reproducer Corp. explains their "Intercast" method of producing zinc-alloy parts with moving elements in a single automatic operation.

26. Mold Materials—Alumina-silica refractories, mold wash materials, ceramic molding media and shell molding minerals are described in literature released by Harbison-Walker Refractories Company.

28. Investment Casting—a brochure offered by Hitchiner Manufacturing Co. outlines the special advantages of the process and shows how to utilize them.

29. Powdered Metal Parts—A fact-filled 12-page brochure, issued by Hoeganaes Sponge Iron Corporation, explains the benefits of powder metallurgy in metal parts production, and design.

31. Die Casting Machines—Bulletin 5400-A, from Hydraulic Press Mfg. Co., describes a line of die casting machines featuring more weight, horsepower, speed, flexibility and savings.

32. Induction Melting Furnaces—Bulletin 70, from Inductotherm Corporation, tells how Inducto furnaces give precise temperature control, controllable analysis, homogeneity and high melting speeds in melting steel alloys.

36. Investment Materials—and other related industrial products are presented in a complete catalog available from Kerr Manufacturing Co.

38. Powder Metal Presses—A complete line of hydraulic and mechanical models in capacities from 10 tons to 500 tons is presented in an illustrated catalog from Kux Machine Co.

39. Die Casting Machines—Information on a complete line is available from Lester-Phoenix, Inc. The units feature reliable clamping, and are readily adapted to vacuum casting.

40. Wax Injectors—Complete specifications and features of three models of all-hydraulic wax injection machines have been issued by Leyden Hydraulics, Inc.

41. Induction Heating—36 illustrated pages, in the new Lepel High Frequency Laboratories, Inc. catalog give valuable information on a complete line of induction heating equipment.

46. Aluminum & Zinc Castings—A new brochure available from Monarch Aluminum Mfg. Co. explains their system of mass-producing aluminum permanent mold castings, aluminum and zinc die-castings, and machining and specialized finishing.

49. Metal Powder—Technical data is available on Grade B-280 Plast-Iron powder. Plastic Metals Div., National-U.S. Raditor Corp.

51. Split Thrust Bearings—which save space and weight and assemble quickly to hold against rotation and high thrust, are presented in an illustrated folder and data sheet. National Molded Products, Inc.

54. Brass Powder Metallurgy—A booklet from The New Jersey Zinc Company contains data for evaluating this production method in terms of particular needs.

55. High Vacuum Furnaces—are described in literature available from Kinney Mfg. Division, The New York Air Brake Company. Covers equipment for melting, alloying, casting, degassing, sintering, annealing, brazing and welding.

59. Sinterings—A brochure entitled, "How to Cut Precision Parts Costs with the Remet Powdered Metal Process", is available from Reese Metal Products Corp.

60. Iron Powder—New MS powder is said to have excellent carbon compatibility for structural parts. Complete data on chemical composition, physical properties, and test evaluations has been released by Republic Steel Corp.

61. Die Components—which cut set-up time and labor costs, are inexpensive, are presented in literature issued by Richards Tool & Mold Co.

62. Investment Castings—Rode Inc. offers a data file of facts on production of high-precision investment castings.

66. Compacting Presses—provide independent press adjustments and direct-reading calibrations for easy set-up and control. Data is available from F. J. Stokes Corporation.

continued on page 46

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- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
- ☐ None of these

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5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
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11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
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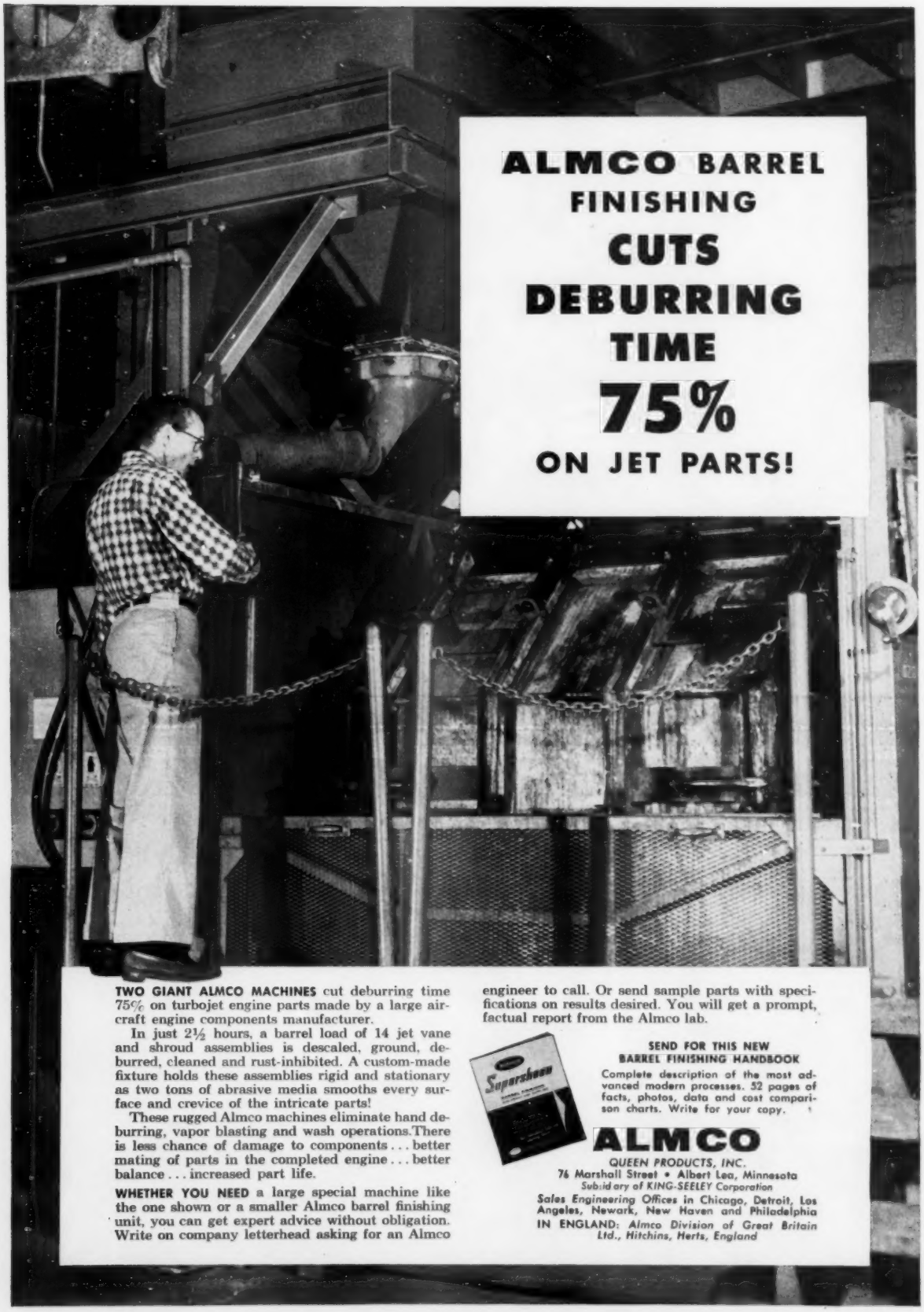
PMM

Finishing Section

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

Mechanical Finishing of dies and molds will lower tooling costs.

see page 47



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TYPE OF FINISH	ZINC	ALUMINUM	MAGNESIUM	BRASS
OLIVE DRAB	.00005			
BROWN			>.0001	
IRIDESCENT YELLOW	.00005	>.00001	.0002	>.00001
CLEAR		>.00001		>.00001
CHEMICALLY POLISHED	.0001			.0001

Figure 1

Finishing Die Castings

Part V: Chromate Conversion Treatments

*By RAYMOND STRICKLEN

IN the finishing of die castings it often happens that the finish costs more than the die casting itself. For example, copper-nickel-chrome plated systems on small parts are expensive.

Chemical finishing, however, is a low-cost method which meets many requirements. Furthermore, it is not subject to uneven distribution due to current density effects.

One of the most versatile forms of chemical finishes is the Chromate Surface Conversion Treatment. These are produced by reacting the metal with an acid chromate solution. A number of formulations for these have been published but the proprietary solutions have lowered costs by providing balanced formulations which operate for extended periods without need for replacement.

Figure 1 shows some of the types available for die castings.

Chromates may be used alone, or in combination with other types of finishes. As a final finish they may be used in their natural colors shown in Figure 1. The heavier coatings may be further colored with organic dyes for such uses as color codes, etc. All of them may be supplemented by clear lacquers to provide abrasion resistance.

As a base for paints, chromates provide excellent bonding both initially and after extended exposure. The chromate coating prevents any soap-forming reaction between the metal and the paint and blocks under-film corrosion when the paint coating is scratched.

Chemical-polishing types of chromates may be used to produce a tarnish-resistant bright finish or they may be used to reduce requirements for buffing ahead of electroplated finishes.

PREPARATION OF WORK

Mechanical finishes previously described in PMM may be applied as required by the standards set for the final finish. The metal and the condition of the work after machining and/or grinding and polishing determines the cleaning cycle used.

The surface after cleaning should be free from "water-breaks" and heavy oxides in order that the chromate treating bath may act evenly on the entire surface. The specific steps in the cleaning cycle should be selected with consideration for the metal and the end result desired.

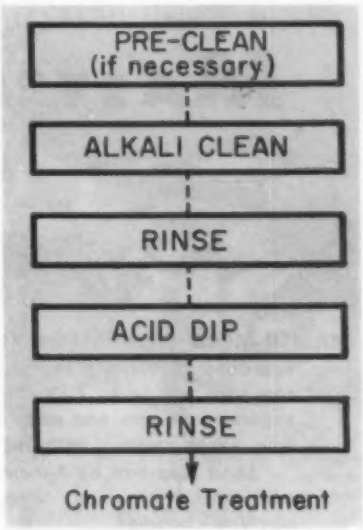

Figure 2

continued on next page

*Product Director, Allied Research Products, Inc.

ZINC

Olive Drab and Iridescent Yellow coatings are applied by the cycle shown in Figure 3.

The treating solutions are prepared according to the manufacturer's instructions by diluting a liquid concentrate or by dissolving a powdered product in water. In the latter case, a small addition of a mineral acid such as nitric may be required to adjust the pH of the solution.

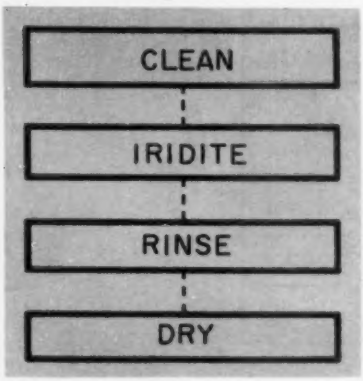

Figure 3

Color standards are easily maintained under small work loads by adding the makeup materials in small increments as required. With high production volumes, it is more economical to control the bath by electrometric pH measurements.

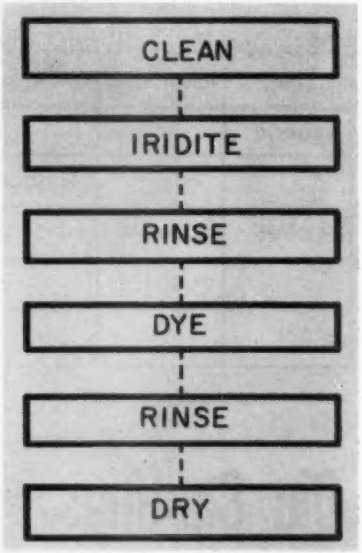

Figure 4

These are supplemented by a simple titration in some cases.

The chromate treating baths generally operate at room temperature and require no ventilation. Immersion time varies from 10 seconds to 45 seconds.

Rinsing and drying complete the operation. The cycle for dyed coatings is shown in Figure 4.

Chemical-polishing chromates for zinc die castings (Figure 5) are formulated especially for the purpose. It is necessary to dissolve the alloying constituents at the same rate at which the zinc is dissolved.

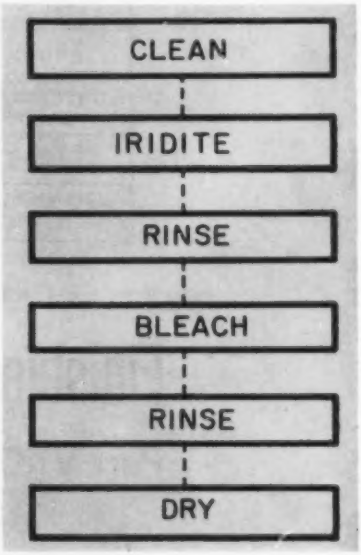

Figure 5

In the chemical-polishing operation, a thin yellow chromate coating is formed on the work. This may be left on if maximum protection from corrosion consistent with a bright surface is desired. The coating accepts dyes, Figure 4.

For a clear finish this yellow coating is bleached in room temperature alkaline solution such as caustic soda at 3 oz/gal.

When chemical-polishing is used to substitute for buffing ahead of plating, the die castings must be of high quality. Defects such as deep scratches, porosity, etc., are emphasized by chemical-polishing. It is advisable to start work through the plating cycle immediately after chemical-polishing and bleaching, and without drying, to insure complete removal of the chromate film. *If not removed, it could interfere with plate adhesion.*

ALUMINUM

The cleaning cycles used on

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aluminum die castings are similar to those used on other aluminum alloys. A non-etching alkali cleaner should be followed by an acid chromate deoxidizer for best results. An etching alkali is followed by an acid bath for smut removal.

If the casting has very low silicon, the acid chromate deoxidizer serves very well. When silicon is high, a solution of nitric and hydroflouric acids is necessary for smut removal on etched work.

The chromate coating material for aluminum is generally supplied as a powder. It is dissolved in water and used at room temperature. The Iridescent Yellow coatings are produced in ½ a minute to 6 minutes as shown in Figure 3.

Clear coatings on aluminum may be obtained by short immersion in the same chromate solution. Another type of chromate permits hot-water bleaching to a nearly clear surface and a third type forms only clear coatings. The application and control of all three baths is similar in that a low concentration of the chromate compound is used, and the pH is adjusted as necessary with nitric acid.

The dying cycle in Figure 4, also applies to coatings on aluminum.

MAGNESIUM

While cleaning cycles for magnesium generally follow the pattern of Figure 2, the specific solutions used are tailored to the job. Alkali soak cleaners are generally fairly strong with a pH of 11.0 or higher to avoid etching.

Acid solutions may be based on chromic acid with various activators for most efficient pickling. If dimensions are critical, hydroflouric acid or an acid flouride salt would be selected.

For maximum protection, the brown coating is used as in Figure 3. The color varies from light to dark brown with the alloy composition. The immersion time for Iridite #15, a proprietary process, is 15 seconds to 45 seconds, as compared with the 30 minutes to 45 minutes required for the older dichromate treatment. The Iridescent Yellow coating noted in Figure 1., is the conventional chrome-pickle process.

COPPER AND BRASS

These metals are cleaned conventionally as in Figure 2. The acid dip is not required if only light tarnish is present. Fire scale is best removed in a warm 10% sulfuric acid solution or in cold 50% hydrochloric acid.

The Iridescent Yellow and the non-polishing clear coating are both applied as in Figure 3. The heavier coating gives good protection to unpainted parts in corrosive atmospheres. The clear coating is a good paint base and also maintains work in solderable condition for extended storage periods.

The chemical polish, Figure 5, for cuprous alloys requires a fine grained homogeneous structure for best results. Coarse grained metal tends to give an orangepeel effect, and leaded alloys may produce a smut, if the immersion time is more than a few seconds.

CONCLUSION

The following characteristics of chromate surface conversion coatings warrant their consideration in choosing a finish for die castings.

1. Low-cost installation. Generally, all that is required in addition to existing cleaning facilities is an acid-resistant tank which is operated at room temperature. Ordinarily, no ventilation is required.
2. Low Material Cost. This varies from 6¢ to 20¢ per 100 square feet for most applications.
3. Ease of control for uniformity.
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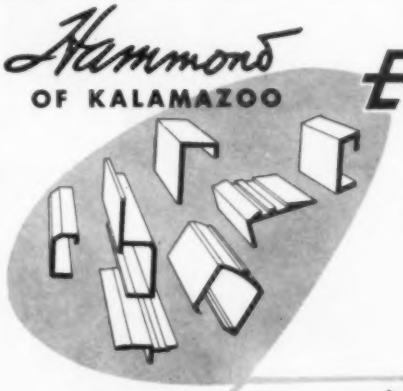

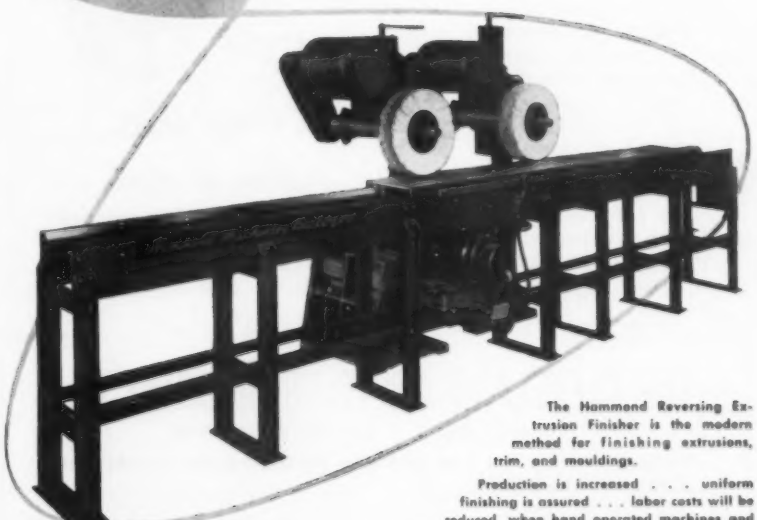

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DATA IN ADS *continued*

68. Fire-Resistant Hydraulic Fluids—The booklet, "Ucon Hydrolubes Spell Safety", from Union Carbide Chemicals Co., gives detailed information, includes laboratory test results and service records.

69. Die Steel—"Thermold AV" die casting die steel, stocked in flats, squares, rounds and billets, can be delivered within a few hours. Universal-Cyclops Steel Corporation offers a descriptive brochure.

72. Investment Casting Services—Westinghouse Electric Corp., Materials Manufacturing Department, will design, engineer and produce parts to customer specifications. Detailed information is offered.

73. Wax Shapes—A catalog available from Yates Mfg. Co. describes their complete stock of wax shapes.

74. Burnishing Materials—in Ball, Ovalball, Cone, Ballcone, Diagonal, and Pin shapes are deep hardened and polished and designed to make effective contact on metal parts of any size and form. Complete information is available from Abbott Ball Company, along with data on abrasives and compounds.

76. Barrel Finishing Handbook—Almco Div., Queen Products, Inc. offers complete descriptions of the most advanced modern processes. Includes 52 pages of facts, photos, data and cost comparison charts.

77. Chromate Color Coatings—for zinc-plated small parts are described in literature about "Luster-On Color", offered by Chemical Corporation.

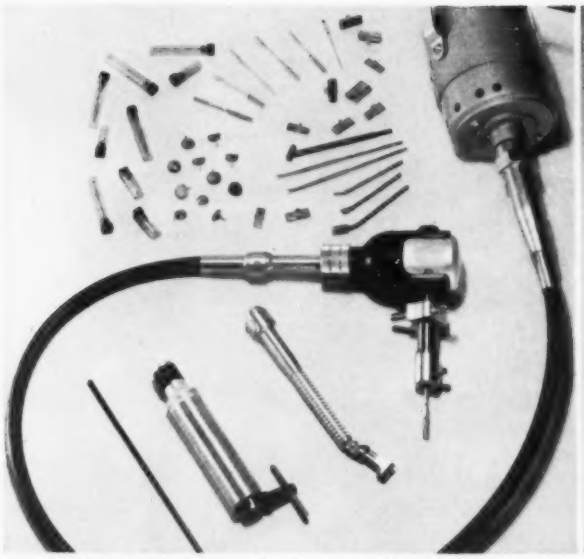
79. Die Grinding—Brochure describes capabilities of "Visual Grind" system in construction of precision high-production dies, dies for powder metallurgy, lamination dies and special purpose dies. Cleveland Grinding Machine Co.

80. Automatic Finishing Machines—clamps and fixtures, mask washing machines, and spray painting masks are presented in literature from Conforming Matrix Corporation.

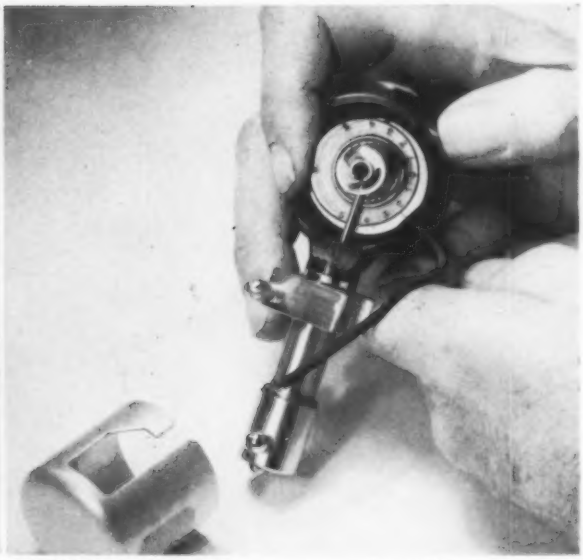
82. Pneumatic Equipment—A 47-page catalog illustrates a complete line of air cylinders, air valves, air clamps, and dial feed tables. A. K. Allen Co.

83. Investment Castings—Gray-Syracuse, Inc., offers a brochure which tells how they produce complex castings in a wide range of alloys; a large number of examples are illustrated.

86. Investment Castings—How to save on simple as well as complex castings is outlined in a new manual from Jelrus Precision Castings.



1. THREE HAND PIECES make the Di-Profiler versatile.



2. STROKE ADJUSTMENT on reciprocating handpiece.

Your tooling costs can be lowered by . . .

Mechanical Finishing of Dies

ONE common denominator of the precision molding industries is the need for precisely finished tooling. This precise finish applies to both fits and surfaces. Many of the shapes made by these processes are highly complex so that standard, powered machine tools can not be used. As a result most of the work is done by hand – particularly when the tools have been hardened prior to final finishing operations.

Many of the die steels show dimensional changes during hardening. This change is predictable within limits but where fits are precise, the final machining must be done after hardening.

Most die steels, and particularly oil hardening steels, will have a light film of oxide on the surface after quenching and tempering. For some uses this light oxide film may not be objectionable. In other cases it must be removed if the part is to have the surface finish required. This oxide film removal is, again a hand operation.

The standard hand tools of the die sinker are files of all types including Swiss pattern files, polishing cloth and compounds, scrapers, and diamond dust. But even with all of the hand tools that can be devised, the work of finishing a die is slow and, particularly at the end of the day, operator-fatigue begins to play an important role in both the quantity and the quality of the work done.

If it were possible to mechanize all or most of these finishing operations, then lowered costs should result. Speed of each operation could be greatly increased since it would not be limited by human reaction times. Operator fatigue would be almost completely eliminated, and with properly designed equipment, damage to both the work and to expensive tools should be almost completely absent. This cuts costs.

But one of the most important skills of the die sinker is for the "feel" of the work. *Educated fingers.* So if any type of mechanism is to do the mechanic's work it must be capable of this same sensitivity or it will fail.

Of the many powered tools designed to reduce the labor of the die sinker and to do a faster job, a recent one is the Di-Profiler. This is an electrically driven tool that can be used for either rotary or reciprocating work.

The speed is adjustable from zero to 100 strokes per second, or from zero to 100 revolutions per second. When used for filing, stoning, scraping or similar operations the stroke can be adjusted from zero to 6 mm (about ¼″). This tool with three different hand pieces is shown in figure 1 and the stroke adjustment mechanism on the reciprocating hand piece in figure 2. A few of the dozens of different tools that can be used are also shown.

Because the hand pieces connect to the motor with a light-weight flexible shaft, the operator does not have to support the motor. This decreases possibility of fatigue and increases the maneuverability so that the all-important sensitivity of the operator is not lost.

(Continued on next page)

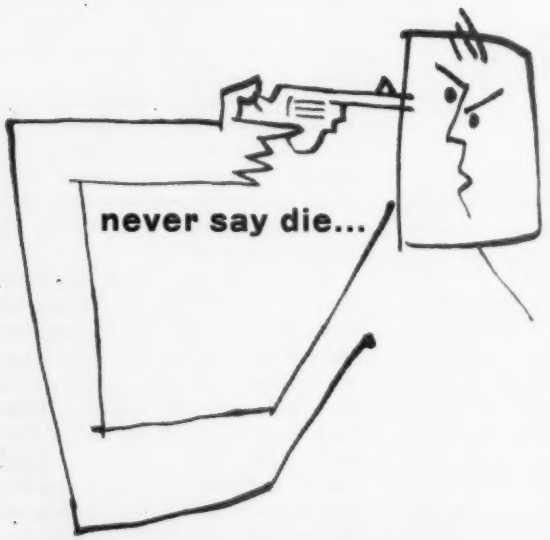
3. AGAINST-SHOULDER filing done without damage to tool.

4. SEVENTY-FIVE STROKES per second finishes die-detail.

One of the slowest jobs the toolmaker has to do is finishing a blind hole or slot without damaging either the work or the tools. Because these powered tools have a precisely adjustable stroke, this sort of work can be done as rapidly as any other, and without any damage to the part.

In some cases where fully hardened steel must be finished the tool maker is faced with an extremely difficult task. But with the use of diamond impregnated tooling or with diamond dust for honing and a mechanically driven tool, this job becomes relatively easy.

With tooling of the sort described above it should be possible to make a major cut in the cost of dies and molds.



say die-cast by Gibbs!

Don't shoot until you see the likes of their dies — we mean Gibbs. Here you have automatic, far faster, more accurate production of zinc casting to 10 pounds, aluminum to 5 pounds. Complete service under one roof including tool room, machining, plating, painting and assembly.

Before you give up, call or write:

GIBBS *Automatic Moulding Corporation*
Henderson 9, Ky. • Valley 6-9573

For more information circle No. 24 on the Reader Service Card

Wherever threaded connections and screwed fittings are subject to prolonged exposure to extreme temperatures—up to 1200°F.—a little Thred-Gard saves a lot on maintenance costs: time, labor, thread stripping and replacement of fittings.

Thred-Gard eliminates seizing and galling, protects threaded surfaces, reduces wrench torque and allows plugs and bolts to be re-used many times over. It permits fittings to be drawn to a greater degree of tightness, yet provides a permanent lubricant that assists dis-assembly.

Order a trial can today.
Request free sample and literature.

CRANE PACKING COMPANY
6473 OAKTON STREET, MORTON GROVE, ILLINOIS *(Chicago Suburb)*
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.
OFFICES IN ALL PRINCIPAL CITIES

For more information circle No. 18 on the Reader Service Card

Introducing Allied's

IRILAC™ #1000

New Clear Protective Coating for All Metals . . . as safe and easy to handle as Water!

New method of protection incorporates corrosion inhibitors in a water-soluble polymer base. Dries to an extremely thin, tough, durable coating—clear in color. Does not chemically affect base metal or any post-treatments. Used as a protective treatment alone or to enhance value of post-treatments.

Allied's new Irilac #1000 is a concentrated solution of a water-soluble polymer with built-in complex corrosion inhibiting materials. It was developed to answer the needs of the metalworking industry for a non-conversion process that will provide corrosion resistance and resistance to fingerprinting and abrasion on base metals and electrochemically or chemically finished surfaces—without changing the appearance of the metallic surface.

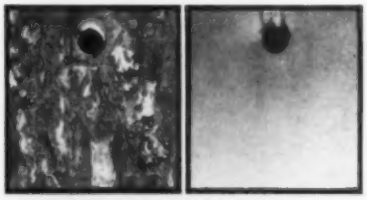
There are no hazards involved—Irilac is non-fuming, non-toxic, and requires no special fire prevention measures.

THE PROCESS

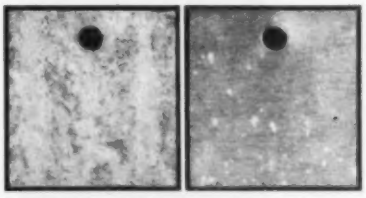
Irilac #1000 is diluted with water to provide a simple one-pass working solution. It is then applied by dip, brush or spray and forms a coating that quickly *bonds* to the metal surface without reacting with the surface.

THE PROPERTIES

The resulting coating is clear, transparent, thin yet durable. It has excellent water-resistant properties, and can be rubbed, handled and subjected to rough treatment. The surface to which Irilac has been applied is not altered—in fact, the transparent coating brings full tone to colored surfaces and clarity to iridescent surfaces. The water-thin physical characteristic of the solution means that the coating provides protection in recessed areas that are difficult, if not impossible, to protect with other methods.



STEEL PANELS: bare (left) and coated with Irilac (right) after 8-hour salt spray.



ALUMINUM PANELS: bare (left) and coated with Irilac (right) after 168-hour salt spray.

WHERE IRILAC CAN BE USED

Irilac #1000 can be applied to *any* metal—wet or dry—treated or untreated. All metals can be processed in *one* operation in the same solution. It can be applied in conjunction with any process—over Iridite, anodized, phosphated surfaces, black oxide, etc. Surfaces treated with Irilac provide a good base for paint.

APPLICATION ADVANTAGES

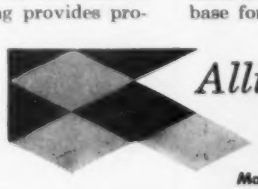
No other process or material available for the protection of metals offers all the application advantages found in new Irilac #1000:

1. It can be applied to any clean metal simply by dip, brush or spray. No special equipment is required.
2. Saves time—just apply and dry—no reaction time required.
3. No hazards involved—no exhaust or special fire protection equipment is required. Irilac is non-fuming and non-toxic.
4. Saves space. Presents no disposal problem. Low in first and final costs.

Because of its versatility and complete safety, Irilac has unlimited uses. For example, it will protect aluminum furniture, brass hardware and fixtures, steel parts of all types, zinc castings, etc. In fact, any base metal or plated surface, or those treated with electrolytic or chemical post-treatments, can be improved or enhanced with Irilac.

IRILAC #1000 MAY BE THE ANSWER TO YOUR PROTECTION PROBLEM

Our development staff will be glad to work with you to determine the significant benefits Irilac can offer you. Simply send us some parts and let us show you what Irilac can do. No obligation, of course.



Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET
BALTIMORE 5, MARYLAND

***Manufacturers of* IRIDITE®, IRILAC™, ARP® Brighteners and Plating Chemicals—West Coast Licensee: L. H. Butcher Co.**

For more information circle No. 75 on the Reader Service Card

DESIGNING

continued from page 28

machining costs is clearly indicated.

The figures given in the two tables were compiled from data furnished by the following foundries. Aluminum Permanent Mold Co.; Bohn Aluminum & Brass Corp.; Bendix Foundries, Eclipse-Pioneer Div.; The Eastern Malleable Iron Co., Eastern Casting Corp. Div.; and Rapidcast Corp.

Individual foundries will vary somewhat from the general figures given in the tables. The safest policy is to consult with your foundryman before design figures are set. However, in most cases any modern foundry using good methods should be able to meet all of the tolerances given in Table I and many, if not all, of those given in Table II. In the two tables, references to figure numbers refer to the sketches shown on the accompanying sketch sheet.

BAILEY

continued from page 17

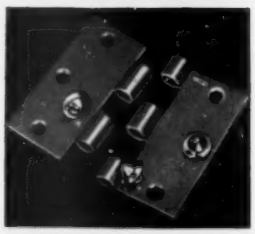
300 ton press of "simplified" design.

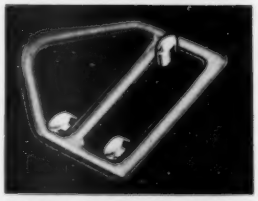
On June 1st, Bailey will retire and plans to return to North Scituate, Mass., the home of the Bailey family since 1670. His retirement will leave a "hole" in the powder metallurgy industry that will be difficult to fill.

JOINS NEW JERSEY ZINC

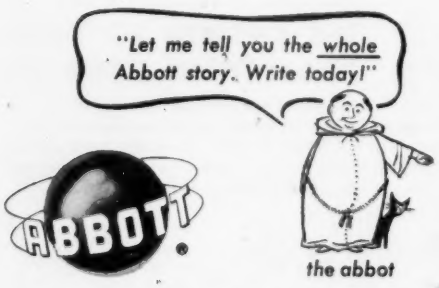
William Rosenquest has joined the metal sales staff of The New Jersey Zinc Company.

in barrel burnishing . . .
it's the SHAPE that counts





ABBOTT BURNISHING MATERIALS . . . Ball, Ovalball, Cone, Ballcone, Diagonal, Pin . . . are scientifically designed to make effective contact on metal parts of any size and form. Each shape is a burnishing tool made of top quality bearing ball steel. Each is deep hardened and polished to the mirror-like, glass-hard finish which produces the *best* burnishing results. Combined with the famed high, narrow Abbott barrel and other Abbott products — abrasives and compounds — these long-lived steel shapes form the dependable Abbott Method of Barrel Finishing.



THE ABBOTT BALL COMPANY
(America's Largest Producer of Carbon Steel Bearing Balls)
1084 NEW BRITAIN AVENUE • HARTFORD 10, CONNECTICUT

For more information circle No. 74 on the Reader Service Card

WILLIAM BRAMMER JOINS PRESSURE CASTINGS, INC.

William N. Brammer

William N. Brammer is now Sales Manager of Pressure Castings, Inc., of Cleveland, Ohio. The company produces aluminum and zinc die castings.

Before joining Pressure Castings, Inc., Brammer was associated with the Light Metals Division of Thompson Products, Inc. During his nine-year tenure with that company, he was in charge of production of aluminum and magnesium die castings. He also worked with sand castings, permanent mold, and investment castings.

He attended Case Institute of Technology, and the University of Pennsylvania before joining Thompson.

Brammer is affiliated with: SAE, ASTM, AFS, and The Non-Ferrous Society of Cleveland. Pressure Castings is affiliated with the American Die Casting Institute.

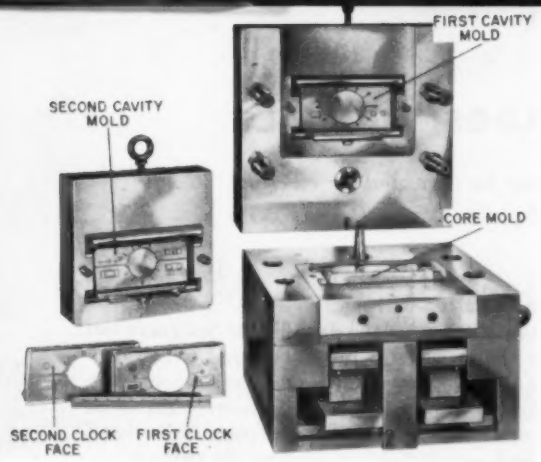
EDWARD HANAGAN IS OAKITE CONTROLLER

Edward D. Hanagan is now serving as the controller of Oakite Products, Inc., in New York City. This is a new post. The company manufactures industrial cleaning and metal treating materials.

BALDWIN-LIMA-HAMILTON COMPLETES RESEARCH LAB

Baldwin-Lima-Hamilton's Hamilton Division is operating its new fully equipped test laboratory in research and development in the field of parts-compacting.

The lab is to be used as a service to the firm's customers.

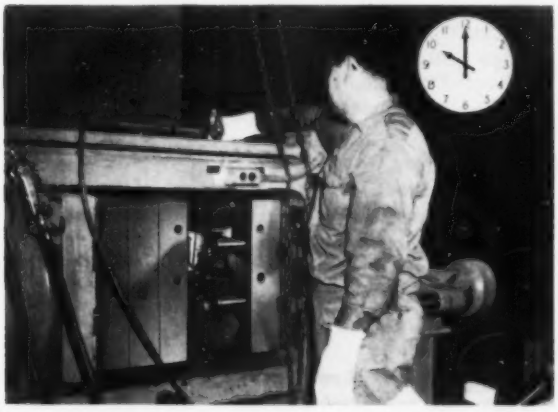


ONE MOLD SET allows the die casting of two clock faces.

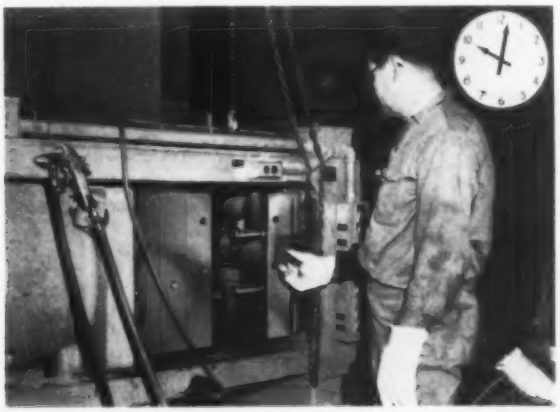
Good Die Design Saves Money

WHEN a die casting machine is shut down, it's costing some one. About $50.00 per hour in the average shop – that's 83⅓¢ a minute. If the machine is shut down to make changes in your dies, you pay for the down time. That down time is why Richards Tool & Mold Co. designed the tools for die casting two clock faces so that only the cavity half of the die needed to be changed. The cavity block stays in the machine and holds proper alignment as well as heat.

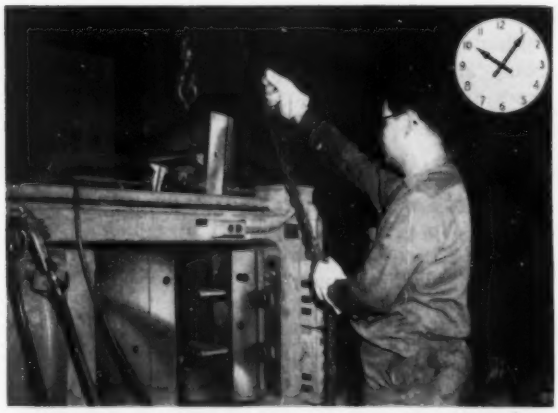
With this design savings were made all along the line. First, the tooling cost $1500.00 less than if complete tooling for both cavity and core halves had to be changed. Second, only one part is changed so that removal of the entire mold set and replacement by another is avoided. This represents a saving of nearly six hours or $14.17 instead of $300.00 for change over charges. These savings are convincing.



1. **DIE CHANGE** starts when the operator fastens an eye bolt into the cavity mold and hooks onto a crane.



2. **ONLY TWO MINUTES LATER** the four hold-down screws are loosened, water inlet and outlet lines disconnected.



3. **OUT COMES** the cavity mold from a specially designed mold set that retains die half alignment.

4. **A NEW CAVITY** mold slides into place. The hold down screws tightened, water lines connected. Time 17 mins.

USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 52-53

PROCESSES

Investment Casting Design: 154

Casting Engineers Inc.—An eight-page brochure, illustrated with photographs of nearly 100 investment cast parts, gives design information; covers such factors as fillets, holes, threads, wall thicknesses and tolerances.

Centrifugal Casting: 155

American Brake Shoe Co. — A new booklet explains centrifugal casting of bronze and copper parts; includes a complete chart showing all alloys available with their specific characteristics, illustrations of typical castings and the company's facilities.

Investment Castings: 156

Jelrus Precision Casting Corp.—A brochure contains a step-by-step explanation of the process, with illustrations, and presents facilities for casting production–from design through finishing operations.

Aluminum & Zinc Castings: 157

Peasley Products, Inc.—A brochure entitled "Improve Your Products! Lower Your Costs!" outlines facilities for producing die castings and permanent mold castings. Emphasis is on quality control and savings possible with unit dies.

Powder Metallurgy Handbook: 158

The Bunting Brass and Bronze Company—24-page booklet contains valuable information on designing powdered metal products, illustrated with engineering drawings. Specifications and physical properties of sintered metals are given, along with information on the company's engineering service.

Plastic Steel Patterns: 159

Alloy Steel Casting Co.—New 4-page illustrated brochure describes a quick, economical method for making duplicate foundry patterns with "Plastic Steel".

Powder Metallurgy Data: 160

Hoeganaes Sponge Iron Corp. — Comprehensive information on the powder metallurgy process is contained in a new handbook. Covers factors to consider in evaluating the process, case histories, stainless, special alloys and other industrial powders.

Castings for Nuclear Service: 161

Cooper Alloy Corporation — The March edition of the CA Newscast, a special nuclear issue, gives data on the design and production of stainless steel valves and castings for nuclear plant components.

Investment Casting Data: 162

Rode, Inc.—A condensed data file for designers and users of Investment Castings is offered which contains charts showing comparative tolerances, sections, finishes, tooling time, and relative costs of all casting processes. Simplification of parts is discussed and available metallurgical services are outlined.

MATERIALS & EQUIPMENT

Electrical Discharge Machinery: 163

Elox Corporation of Michigan — Machine tools for broaching, drilling, die sinking and grinding, which remove metal by electrical discharge, are described in new bulletins. An engineering handbook compares the method with conventional means in the manufacture of cavity type dies.

Aircraft & Missile Couplings: 164

Snap-Tite, Inc. — A 26-page catalog describes special quick connect/quick disconnect couplings for pressures up to 3300 psi. The units are remotely activated by solenoid or lanyard action; emergency manual disconnect is optional.

Aluminum Alloy Castings Facts: 165

The Permold Company—Technical information on aluminum permanent mold and sand castings, with data as to their application, specifications, physical properties and characteristics, is presented in a 24-page folder.

Optical Gauging: 166

Eastman Kodak Company—Advantages of optical inspection are presented in a 15-page booklet. Complete specifications, drawings and photos of a line of Kodak Contour Projectors are included.

Dew Point Measurement: 167

Illinois Testing Laboratories, Inc. — An 8-page bulletin describes the Alnor Dewpointer, which uses the principle of varying pressure in determining dew points of any gas sample.

Instrument Repair Service: 168

Leeds & Northrup Company—Folder EN 6 gives details of a new 4-echelon factory instrument repair service. The user may specify the type of repair to be made on his equipment.

Vacuum Gages: 169

F. J. Stokes Corp.—Data sheet No. 561 lists specifications and features of Stokes McLeod type gages for measuring high vacuum on production systems.

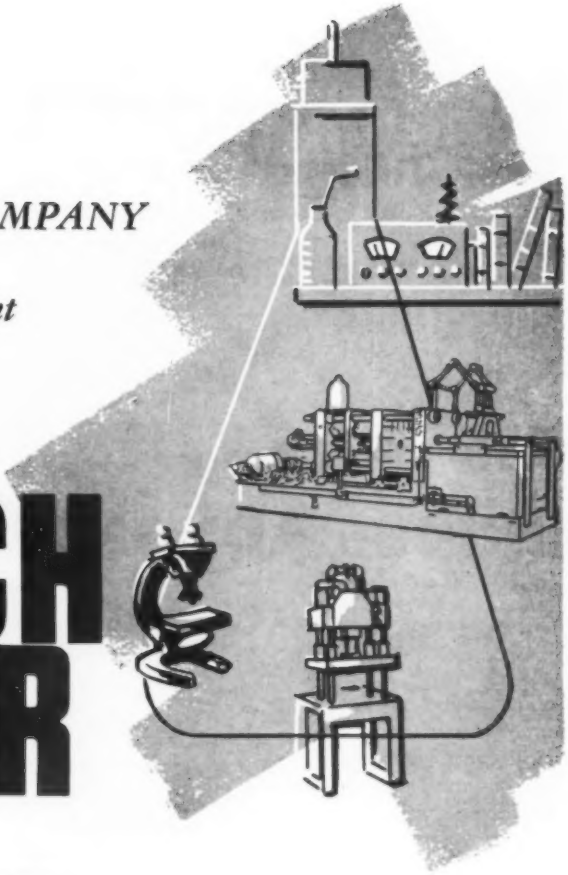
continued on page 54

B&T MACHINERY COMPANY

announces the establishment

of a new

RESEARCH CENTER



for the use of DIE CASTERS

. . . well equipped, individually located, and entirely non-commercial, this center is dedicated to the advancement of automation, the use of vacuum attachments, control of temperatures, lubricants, variable shot control and other phases of the die casting art.

All Die Casters are cordially invited to use these facilities as a possible perfection of their die casting technique.

B&T MACHINERY COMPANY manufactures a complete line of Die Casting Machines, both cold chamber and gooseneck types, in capacities of: 100, 200, 300, 400, 500, 600, 750 and 800 tons. Also Hydraulic Presses.

PRECISION BUSS MACHINERY

B & T MACHINERY COMPANY

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SUBSIDIARY OF BUSS MACHINE WORKS — MANUFACTURERS OF MACHINERY SINCE 1862
REPRESENTED IN CANADA BY UPTON BRADEEN & JAMES, LTD.

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For your zinc or aluminum

Instrument Parts

Small Engine Cylinders

DIE CASTINGS CHOOSE ADVANCE

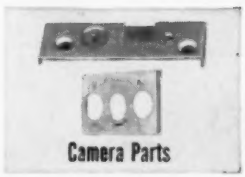
because . . .

above and beyond the measurable factors of metallurgical control and mechanical equipment (which others may also possess to a degree) there are at ADVANCE creative engineering, in-plant tool making, production skill and management attitudes toward customer requirements not always encountered in run-of-the-mill markets.

ADVANCE supplies zinc and aluminum components to fine product makers from Texas to Massachusetts as well as to its good neighbors in the Mid-west. Geographical distance is no barrier to quality production.

So . . . check with ADVANCE for your zinc or aluminum die casting requirements.

Motor Housings


Camera Parts

Control Valve Components

Valve Cases

These symbols are your assurance of highest quality control of zinc and aluminum alloys under ADCI standards

ADVANCE TOOL AND DIE CASTING CO.

38 years of service to industry

3782 N. Holton St.
Milwaukee 12, Wis.

For more information circle No. 1 on the Reader Service Card

USEFUL LITERATURE

continued from page 52

Die Lubricants: 170

Acheson Colloids Company—Vol. 3, No. 1 of the "Dag Disperser" contains stories highlighting the varied uses of colloidal dispersions as lubricants, parting agents, anti-seize compounds, cutting fluids, etc.

Surface Pyrometer: 171

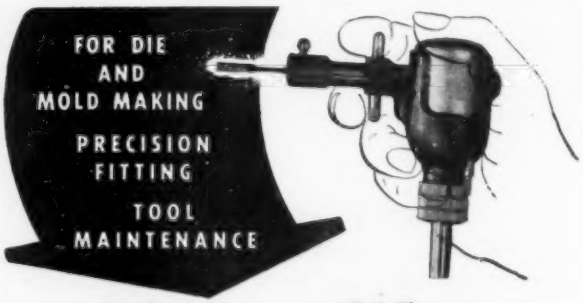
The Pyrometer Instrument Co., Inc. — Model DR-35, for plant and laboratory surface and subsurface temperature measurements, has two ranges; a low range from 0-500°F, and a high range from 0-1500°F. Scale is changed by a convenient range selector switch. Bulletin No. DR35 contains complete information.

Vacuum Spectrometer: 172

Applied Research Laboratories — "Quantovac" gives simultaneous quantitative results for all important elements, including phosphorous, sulfur and carbon, in less than 2 minutes. Unit provides permanent inked records showing concentrations of all elements in steel. Operation is illustrated and described in a brochure.

Heat Treating Furnaces: 173

C. I. Hayes, Inc. — Bulletin 5711 presents specifications and features of conveyor furnaces for high production; units have variable speed drive, auto-



THE Di-Profiler

***Flexible Shaft* RECIPROCATING TOOL**

Fast, accurate, versatile

For grinding, filing, scraping, honing, lapping, polishing — the Di-Profiler saves hours of tedious hand labor — especially on intricate, detailed, hard-to-get-at jobs.

Driven by flexible shaft, the machine is light, sturdy, free from vibration. The speed of reciprocation is controlled by foot rheostat and can be varied from 0 to 100 strokes per second; the length of stroke is adjustable from 0 to ¼-inch.

Write for Free Demonstration or Illustrated Price List DV-68

ENGIS EQUIPMENT COMPANY
431 S. Dearborn St., Chicago 5, Ill.

For more information circle No. 22 on the Reader Service Card

matic control of temperatures up to 2100°F. Bulletin 5709 describes the "Vacu-Master" furnace, which holds .1 vacuum throughout a temperature range of from 600°F. to 2150°F.

FINISHING

Production Cleaning Data: 174
Chlorinated Products Division, Diamond Alkali Co. — "Vapor Degreasing Using Diamond Perchlorethylene" is the title of a 12-page technical bulletin now available. The bulletin presents data covering 13 major advantages provided by vapor degreasing in production cleaning and metal surface preparation for electroplating, painting and other finishing operations.

Automatic Deburring: 175
Acme Manufacturing Co. — A 12-page illustrated catalog describes automated deburring machines ranging from types specifically designed for low and medium-volume production plants to completely automated types for high production lines. An introductory section discusses the application of various types of deburring tools.

Water Demineralization: 176
Graver Water Conditioning Co. — The applications of demineralizers, basic principles of operation and the chemistry of the ion exchange resins are covered in bulletin WC-111A. Comprehensive comparison charts on multi-bed, mixed-bed and scavenger demineralizers are included.

SELECT CENTURY
FOR SPECIAL SHORT RUN
DIE CASTINGS

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MODERN EQUIPMENT TO MEET YOUR DIE CASTING NEEDS

SHORT RUNS
Small quantities made economically in both Zinc and Aluminum Alloys

UNIT DIES
For both Zinc and Aluminum Castings at a much lower die cost than conventional dies.
Unit Dies cover a wide range of casting sizes to fit your needs.

Consult Us on Your Requirements

CENTURY DIE CASTING CO.
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TELEPHONE: IRving 8-2629

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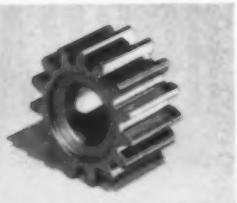
HOW CAN BRASS POWDER METALLURGY CUT COSTS FOR YOU?

BRASS POWDER FINGER GRIP FOR SORTING MACHINE


BRASS INFILTRATED GEAR FOR WASHING MACHINE

BRASS POWDER
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ICI SPRING TECH-SESSION TO BE AT MUSKEGON, MICH. ON JUNE 23, 24, AND 25

The special two-and-one half day technical session of the Investment Casting Institute scheduled for Monday, Tuesday, and Wednesday, June 23, 24, and 25, is designed to incorporate some of the features of the ICI university course in investment casting.

Plant visits are lined up for Monday morning, June 23. These have been planned so that each member attending will have the chance to visit two plants. These firms include the Misco Precision Casting Co., at Whitehall, Mich., and the Cannon-Muskegon Corp.

At Cannon-Muskegon a demonstration of vacuum melting and pouring will be featured. Stokes and Kinney Mfg. Division are cooperating in this demonstration.

Tuesday's sessions will be highlighted by speakers from: The University of Michigan; Chance-Vought Aircraft, Inc.; Wai Met Alloys Co.; and Haynes Stellite Co. Among Wednesday's speakers are several from Misco Precision Castings Co.

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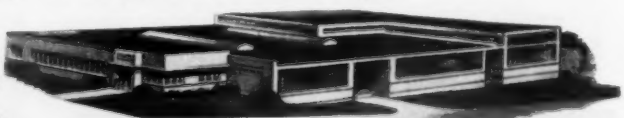

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JUNE 1958

PMM 3rd Annual

INVESTMENT CASTING DIRECTORY

PRECISION

METAL

MOLDING

1 REFERENCE DATA

2 PRODUCT LISTING

3 BUYERS' GUIDE

3rd annual

INVESTMENT CASTING DIRECTORY

SECTION 1

TECHNICAL SECTION

The chemistry, physical and mechanical properties of commonly cast ferrous and non-ferrous alloys.

The investment casting process is unique among the foundry industries. With this process any castable metal can be used. Because of this great versatility there has been a tendency among metallurgists and designers to call for special alloys that have only small differences when wrought in mechanical and physical properties from a more standard alloy. Any as-cast differences are, therefore, minor.

There is another disadvantage in using special alloys. They cost a lot more. Therefore, use standard alloys whenever possible.

ALUMINUM BASE ALLOYS

The aluminum-silicon and aluminum-magnesium-silicon alloys are the most easily and dependably cast. Most other alloys are sluggish when poured and often fail to fill the mold in areas of fine detail. This is especially true of alloys that contain appreciable amounts of copper. Even in the group of heat-treatable alloys, those containing copper are losing favor to heat-treatable silicon-aluminum materials.

COPPER BASE ALLOYS

The best, general purpose brass is silicon brass. It has good strength, can be cast with an excellent surface and reproduces detail excellently. When a heat-treatable alloy is required, beryllium-copper is one of the most favored alloys. The one trouble with this alloy is the difficulty of holding the beryllium content constant.

Red brass is another good foundry brass and the best leaded brass for castability. It does not reproduce fine detail as well as silicon brass. Phosphor bronze, manganese bronze and nickel silver all have fair foundry properties and produce good castings.

MAGNESIUM BASE ALLOYS

Of the many magnesium base alloys available only one, commonly known as Dowmetal C is satisfactory for investment casting. Other alloys, particularly those modified with rare earth elements, cerium, beryllium and lithium are not sufficiently different, in their as-cast properties, to justify casting them.

PLAIN CARBON & LOW ALLOY STEELS

Plain carbon steels with carbon contents below 0.8% are generally difficult to cast. They tend to produce parts with rough surfaces so that subsequent machining is often needed. While several low carbon steels are commonly cast they should generally be avoided if possible.

About eight different low alloy steels are widely used in investment casting. The castability, freedom from cavitation and excellent surface and detail reproduction make these steels prime favorites. In many cases the lower machining required and the lower number of rejected castings more than compensate for the higher metal costs. As a result, castings in low alloy steels are frequently less costly than the same casting in a plain carbon steel.

STAINLESS STEELS

All of the austenitic stainless steels have been widely cast. In the 300 series, types 302, 303 and 304 are generally considered the most castable. Types 316, 321 and 347 sometimes tend to show pitting.

All of these alloys are difficult to machine when investment cast, including type 303 which is supposed to be free machining.

The martensitic steels vary in their castability. Types 410 and 416 are usually considered difficult due to their tendency to pit. Types 420 and 430 show very little pitting and with 440C or F pitting is negligible. Where hardenability and freedom from pitting are essential Armco 17-4 P.H. may be used. This is, of course, an age hardenable austenitic steel.

TOOL & SPECIAL STEELS

There are a tremendous number of tool steels all of which can be reduced to about 12 basic classes. Of these a very few are commonly investment cast. Four general classes will meet most requirements.

In this category can be listed the nickel base alloys, cobalt base alloys and the "super" alloys, generally chromium base or nickel base. The particular needs of the part being designed will dictate which of these alloys is to be used.

From this very general discussion it would seem that a comprehensive list of alloys could be prepared that would cover most applications of investment castings. Such a tabulation has been prepared from data furnished by representative foundries. In some cases the chemistry of a specified alloy has been slightly modified to give the best investment castings. Use the data in these tables rather than figures that have been published for some other casting method or for wrought stock. Mechanical properties are for guidance only. The precise properties will depend on the casting configuration and on foundry practices.

Companies who have contributed data and information for this section are: 1 Alloy Precision Castings Co., 2 Arwood Precision Casting Corp., 3 Austenal, Inc., 4 Crucible Steel Co. of America, 5 Haynes Stellite Co., 6 The International Nickel Co., 7 Kolcast Industries, 8 Lawrence Laboratory, 9 Mercast Manufacturing Corp., 10 Misco Precision Casting Co., 12 Frank Roth Co., Inc., 13 Universal Casting Corp., 14 Vascaloy-Ramet Corp., and 15 Westinghouse Electric Corp. (The numbers preceding the company name refer to the code listing in the tables).

NON-FERROUS BASE ALLOYS WIDELY INVESTMENT CAST

COMPOSITION												PROPERTIES									CODE
												AS CAST				AS HARDENED					
COPPER BASE																					
Type	Si	Mn	Cr	Ni	Cu	Mg	Al	Pb	Sn	Zn	Other	Tensile Psi (Ultimate)	Yield Psi	Elongation %	Hardness	Tensile Psi	Yield Psi	Elongation % in 2"	% Red of area	Hardness	
Beryllium Copper	.35 Max		.005 Max		Bal		.15 Max	.02 Max		.10 Max	.25 Fe Max .3-.65 Co 2.5-3 Be	75,000	40,000	30%	75-90 RB	175,000	155,000	1%		40,44 RC	1
Silicon Brass	3 5				Bal			.5 Max		12 16		60,000	24,000	15%	56-58 RB						1
Navy Bronze ASTM-B-143-1B				1 Max	86 89			.3 Max		3 5	.15 Fe Max	40,000	18,000	20%	48-51 RB						1
Bronze AMS4640		1.5 Max		4.5 5.5	78 Min		9.7 10.9		.2 Max	.3 Max	2-3.5 Fe	85,000	40,000	10%	87-90 RB						1
#10 Brass U-1		.5 Max		.5 Max	62 57		.5 Max	1.5 Max	2 1	Bal	.5 Fe	50,000	25,000	15%	50-70 RB						13
Mn Bronze U-2		1.5 Max		.5 Max	60 55		1.5 .5	.4 Max	1 Max		2-.4 Fe	65,000	25,000	25%	56-76 RB						13
22% Nickel-Brass U-3		.75 Max		23 21	56 52		1 Max	1 Max	5 3	Bal	1 Fe Max	50,000	47,000	3%	80-90 RB						13
Mn Bronze (High Strength) U-4		5 2.5			60 60		7.5 3	.2 Max	.5 Max	Bal	4-2Fe	90,000	60,000	5%	85-95 RB						13
#20 Aluminum Bronze U-5		2 Max			82 Min		10 Min				5 Fe	83,000	30,000	9%	80-90 RB						13
ALUMINUM BASE																					
356	6.5 7.5	.3 Max			.2 Max	.2 .4	Bal			.3 Max	.6 Fe Max .2 Ti Max	22,000	15,000	.7 Min		(2) 32,000	28,500	3%	5%	65 Min BHN	1, 13
355	4.5 5.5	.5 Max			1 1.5	.4 .6	Bal			.3 Max	.8 Fe Max .2 Ti Max	22,000	15,000	.5 Min		(2) 33,000	29,000	2.5%	4%	70 Min BHN	1
40-E	.25 Max	.3 Max	.4 .6		.3 Max	.5 .7	Bal			5 6	1 Fe Max .1-.3 Ti					(3) 32,000	22,000	3%		65 Min BHN	1
Tern Alloy #7	.2 Max	.4 .6	.2 .4	.2 Max	.2 Max	1.8 2.4	Bal			4 4.5	.8 Fe Max .2 Ti Max	30,000	19,000	2%	65 Min BHN	(2) 40,000	37,000	.5		75-85 BHN	1

FERROUS BASE ALLOYS WIDELY INVESTMENT CAST

COMPOSITION										PROPERTIES										CODE
										AS CAST OR ANNEALED					AS HARDENED					
STAINLESS																				
TYPE	C	Si	Mn	S	P	Cr	Ni	Mo	Other	Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	
302	.08 .15	1 Max	1.5 Max	.03 Max	.04 Max	17 Max	7 Max	.5 Max	.5 Cu Max	80,000	40,000	45%	60%	84-86 RB						1, 15, 3, 10, 4

Check manufacturer's code-list on page 58.

Type	C	Si	Mn	S	P	Cr	Ni	Mo	Other	AS CAST OR ANNEALED: Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	AS HARDENED: Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	Code
303	.2 Max	2 Max	1.5 Max	.2 .4	.05 Max	18 21	9 12	.4 .8		75,000	30,000	35%	35%	80 RB						1, 4, 3
310	.18 Max	.5 1.5	2 Max	.03 Max	.04 Max	23 26	19 22	.5 Max	.5 Cu Max	60,000	25,000	40%	60%	70 RB						1, 15, 10, 5, 9
316	.15 Max	.75 Max	1.5 Max	.03 Max	.04 Max	16 18	12 14	1.5 2.25	.5 Cu Max	81,000	34,800	48%	55%	73-75 RB						1, 15, 10, 4, 3, 5
347	.12 Max	1 Max	2 Max	.03 Max	.04 Max	18 19.5	10 14	.5 Max	Cb & Ta 10 x C Min 1.5 Max	77,500	40,000	44%		73-75 RB						1, 15, 10, 4, 5
ARMCO 17-4-PH AMS 5355	.07 Max	1 Max	1 Max	.03 Max	.04 Max	15.5 17.5	3 5		3-5 Cu	167,000	87,000	1%	2%	38-41 RC	180,000	115,000	6%	5%	40-45 RC	1, 10, 4, 9
410	.15 Max	1 Max	1 Max	.03 Max	.04 Max	11.5 13	.5 Max	.5 Max	.5 Cu Max	156,000	143,000	3.5%		32-28 RC	204,000	128,000	6%	10%	40-44 RC	1, 15,10, 4, 3, 5, 9
420	.2 .4	1.5 Max	1 Max	.03 Max	.04 Max	11.5 14	1 Max	.5 Max	.5 Cu Max	100,000	76,000	4%	1.5%	27-30 RC	220,000	165,000	1%		45-48 RC	1, 15, 4, 5
431	.12 .20	1 Max	1 Max	.04 Max	.04 Max	15 17	1.5 3	.5 Max	.5 Cu Max	*120,000	90,000	15%	20%	26 RC	140,000 180,000	100,000 130,000	15% 10%	30% 15%	30 RC 42 RC	1, 4, 3
440-A	.60 .75	1 Max	Max 1	.03 Max	.04 Max	16 18		.75 Max		102,300	92,200	2%	3%	36-40 RC					58 RC	1, 4, 5
304	.08 Max	2 Max	1.5 Max	.04 Max	.04 Max	18 21	8 11			77,000	37,000	55%		140 BHN						15, 10, 4, 5, 9
416	.1		.4	.3		12.2				125,000	113,000	11.4%	23.1%	25 RC						4
1020	.18 .23	.75 Max	.3 .6	.05 Max	.04 Max					* 70,000	35,000	25%	40%	77 RB	125,000	100,000	15%	40%	30 RC	1, 15, 4, 3
1035	.32 .38	.75 Max	.6 .9	.05 Max	.04 Max					* 85,000	45,000	20%	35%	84 RB	150,000	130,000	5%	15%	38 RC	1, 15, 4, 3
1095	.9 1.05	.75 Max	.3 .5	.05 Max	.04 Max					*125,000	65,000	5%	5%	25 RC						1, 15, 3
4140	.35 .45	1 Max	.5 1	.03 Max	.04 Max	.8 1.1		.15 .25		132,200	117,200	4.5%	7%	28-32 RC	180,000 155,000	150,000 142,000	6% 9%	17%	39-43 RC 33-46 RC	1, 15, 10, 4, 3, 5
4340	.38 .43	.75 Max	.6 .8	.04 Max	.04 Max	.7 .9	1.65 2	.2 .3		*100,000	60,000	20%	45%	93 RB	200,000	170,000	5%	20%	43 RC	1, 15, 3, 9
4620	.15 .25	.75 Max	.75 Max	.03 Max	.04 Max		1.5 2	.2 .3		96,000	59,000	14%	26%	85-95 RB	130,000	110,000	15%	25%	26-30 RC	1, 15, 4
6150	.45 .55	1 Max	.5 1	.03 Max	.04 Max	.8 1.1			.15 V Min	115,500	91,400	2.5%	1.5%	25-28 RC	225,000	200,000			62 RC	1, 5
8620	.18 .23	.75 Max	.7 .9	.04 Max	.04 Max	.4 .6	.4 .7	.15 .25		* 85,000	40,000	20%	40%	85 RB	110,000 115,000	90,000 120,000	20% 10%	53% 30%	22-23 RC	1, 15, 10, 4, 3
52100	.95 1.1	.75 Max	.6 Max	.03 Max	.04 Max	1.25 1.6				110,000	108,000	1%		24-27 RC					63 RC	1, 15
4130	.28 .33	1	.4 .8	.03	.04	.8 1.15		.15 .3							150,000 175,000	130,000	6%		33-37 RC	1, 15, 10, 4, 5
1010	.08 .13	.4 Max	.3 .6	.04 Max	.04 Max										55,000 63,000		35% 31%	50% 45%	89-91 RC	15
1080	.75 .88	.2 Max	.7 1	.04 Max	.04 Max					118,000		7%	10%	27 RC	130,000		10%	13%	131 RC	15

Check manufacturer's code-list on page 58.

4640	.38 .43	.65 Max	.6 .8	.04 Max	.04 Max		1.65 2	.2 .3		130,000		2%	7%	36 RC	97,000 115,000		15% 3%	31% 10%	24-36 RC	15

Type	C	Si	Mn	S	P	Cr	Ni	Mo	Other	Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	
Water Hardening	.45 .55	.8 1.2	.3 .6	.03 Max	.04 Max			.4 .6		100,000	68,000	18%	23%	20-22 RC					63 RC Max	1
Oil Hardening	.85 .95	.75 Max	1.2 1.5	.03 Max	.04 Max	.4 .6			.3-.5 W	145,000	118,000	1%	1%	39-42 RC					63 RC Max	1, 4
Air Hardening	1.4 1.6	.75 Max	1 Max	.03 Max	.04 Max	10 12		.7 .9	.1-.25 V	107,000	86,000	1.5%	2%	35-38 RC					63 RC Max	1, 4
High Speed	.65 .85	.75 Max	.75 Max	.03 Max	.04 Max	3.5 4.5		.6 .8	1-1.25 V 17-19 W 4-6 Co					45-55 RC					66 RC Max	1, 4
S-Monel	.3 Max	3.5 5	.5 1.5	.03 Max	.04 Max		62-68		3.5 Fe Bal Cu	134,900	121,000	6%	6%	33-38 RC	140,000	126,000	2%		42 RC Max	1
Monel	.3 Max	1 2	.5 1.5	.03 Max	.04 Max		62-68		2.5 Fe Bal Cu	65,000	32,500	25%		76 RB						1
Beryllium Nickel	.4 Max					.8 Max	Bal		2.55-2.8 Be	115,000	60,000	7%	5%	24-30 RC	200,000	190,000	0-2%	0-1%	52-56 RC	1
Hastelloy-X						22	Bal	9	18.5 Fe 1.5 Co .6 W	68,000		20%								10, 5
Hastelloy-C						16	Bal	17	4.5 W 6% Fe	81,000		10%								10, 3, 5, 15

Type	C	Si	Mn	Co	W	Cr	Ni	Mo	Other	Other	Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	Tensile Psi (Ultimate)	Yield Psi	Elongation %	% Red of Area	Hardness	
AMS 5388B	.15 Max	1 Max	1 Max	2.5 Max	3.75 5.25	15.5 17.5	Bal	16 18	4.5-7 Fe	.2-.6 V	80,000	50,000	5%	5%	20 RC						1, 15
AMS 5382B	.45 .55	1 Max	1 Max	Bal	7 8	24.5 26.5	9.5 11.5		20 Fe Max		110,000	80,000	8%	10%	30 RC	125,000	110,000	2%	3%		1, 15, 3
AMS 5376B	.2 Max	1 Max	1 2	18.5 21	2 3	20 22	19 21	2.5 3.5	75-1.25 Cb & Ta	Bal Fe	95,000	55,000	25%	15%	85 RB						1, 15, 3
AMS 5385C	.2 .3	1 Max	1 Max	Bal		25 29	1.75 3.75	5 6	3 Fe Max		100,000	80,000	8%	10%	28 RC	120,000	100,000	2%	3%		1, 15, 3
309 (Mod)	.15 .3	.75 2	1 Max		2.5 3.5	22 25	11 14		Bal Fe		80,000	40,000	15%	25%	80 RB						1, 15
Inconel X	.08 Max	.5 Max	.3 Max			14 16	70 Min		5-9 Fe .7-1 Cb	2.25-2.75 Ti .4-1 Al						105,000	85,000	4%	6%	29 RC	1, 15, 3
Waspaloy (1)	.1 Max	.75 Max	.5 Max	12 15		18 21	Bal	3.5 5	2 Fe Max 1-1.5 Al	2.75-3.25 Ti						115,000	90,000	6%	7%	30 RC	1, 15
Udimet 500 (1)	.15 Max	.75 Max	.75 Max	13 20		16 20	Bal	3 5	4 Fe Max 2.5-3.25 Ti	2.5-3.2 Al						125,000	100,000	5%	6%	35 RC	1, 15
Inconel	.2	2	1			16	Bal		8 Fe		70,000	42,500	16%								6
Inconel 713C	.2	1	1			11 14	Bal	3.5	5.5-6.5 Al .25-1.25 Ti 1-3 Cb		120,000	105,000	5%								6
30				Bal		25	15	6			96,000		10%								10
31X-40				Bal		25.5	10.5		7.5 W		113,000		8%								10, 15, 4
21				Bal		27	2.8	5.5			101,000		8%								10, 15, 4, 5
36				Bal		18.5	10		15 W		102,000		5.5%								10
23		.6	.3	65		25	2		1 Fe 6 Ti		111,000	86,800	9%	12%							15
1	2.45			46		31	3		2.5 Fe 13 W		78,000				58-61 RC						15
6	1.25			56		27.5	3		2-5 Fe 4-5 W		105,000				44-48 RC						15, 5
12	1.35			56		31			2 Fe 8 W		76,000				46-49 RC						15, 5

Check manufacturer's code-list on page 58.

In making these small valve wedges

Inco investment casting eliminates 5 machining steps...cuts costs 30%

Originally William Powell Company made these small wedges from Monel* nickel-copper alloy bar stock . . . using six separate machining steps.

But costs from labor and machining time ran high. Powell engineers figured that casting these Monel wedges would cut expensive machining steps. But could this wedge design be cast close enough to final specifications? They brought their problem to the Inco Foundry.

Inco recommended investment casting. Showed Powell how a few non-functional design changes made the Monel wedge ideal for production lot quantities.

Powell gave the go-ahead. Results with Inco investment casting . . . only one machining step is still required. And Powell's production cost for the Monel wedge is down better than 30%.

How can Inco investment casting cut your production costs?

If your product contains metal parts that are 6x5 inches or smaller, weigh under 3 lbs., require starting tolerances of plus or minus 0.005 inch per linear inch, and need 5 or more fabricating steps, look into Inco investment casting. You can often obtain the part with little or no machining and at a substantially lower cost.

Send us a sample or blueprint. Our Engineering Department will be glad to submit their recommendations and quotations on Inco investment castings. *Registered trademark

5 Advantages of Inco Investment Castings

- Save up to 60% of production costs.
- Longer life with harder alloys.
- Little or no machining required.
- Wider design latitude.
- Higher alloys at lower cost.

"Cast to outlast"

This helpful 16-page booklet is filled with illustrated case histories. Some of them may suggest practical answers to your small parts cost problems. Write Inco for your copy.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK

INCO-CAST PRODUCTS

For more information circle No. 34 on the Reader Service Card

3rd annual INVESTMENT CASTING DIRECTORY

SECTION 2

PRODUCT LIST

INVESTMENT CASTINGS

Aluminum Alloys

Advanced Jewelry Casting Co.
Areo Investment Castings Co.
Airtron, Inc.
All Alloy Precision Cast
All-Metals Precision Casting Corp.
Alloy Precision Castings Co.
Arnold Foundry
Arrow Acme Corp.
Arwood Precision Casting Corp.
Bone Engineering Corp.
Brace, Inc.
Budd-Stanley Co., Inc.
Cadmet Corp.
California Precision Castings, Inc.
Castalloy Corp. of Illinois
Centrifugal Casting Co.
Cranston Casting Co., Inc.
Crestline Products Co.
Cuker Processing Co.
L. G. Daniels Co.
Dean Precision Castings, Inc.
Deloro Stellite
Duncan-Rohne & Co.
Engineered Castings, Inc.
Engineered Precision Casting Co.
F-R Machine Works, Inc.
Ferriot Bros., Inc.
Ferro Cast Corp.
Gowin & Keleher, Inc.
Gray-Syracuse, Inc.
Hampshire Casting Co.
Harcast Co.
Hitchiner Mfg. Co., Inc.
Howard Foundry Co.
Humphrey Castings, Inc.
Illinois Precise Casting Co.
Industrial Casting Corp.
Industrial Fine Castings Ltd.
Intricast, Inc.
Investment Casting Co. (N. J.)
Investment Casting Co. (Pa.)
Jelrus Precision Casting Corp.
Joseff
Kemtron Products Co.
Kolcast Industries, Inc.
Lawrence Laboratory
Liebros Casting Co., Inc.
Kenneth Lynch & Sons
Lynn Casting Corp.
M & M Precision Casting, Inc.
Martin Mfg. Co.
Mercast Mfg. Corp.
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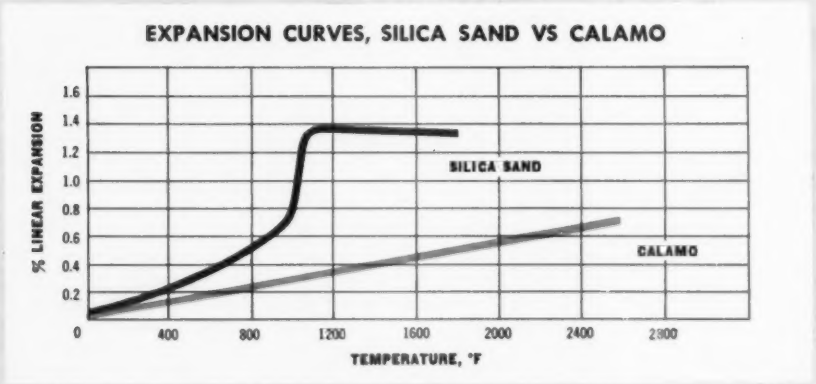
Harbison-Walker

REFRACTORY MOLD MATERIALS

for metal casting



Calamo for Investment Molds

CALAMO, one of the extensively used Harbison-Walker products for molding is an alumina-silica refractory of optimum sizings for various molding mixtures. Its fusion point is 100°F. higher than that of normal silica sand mixes.

The chart above shows the exceedingly desirable expansion curve of CALAMO as compared with that of silica sand.

CALAMO, used as the major constituent of precision casting investment mixes, improves the dimensional constancy of the molds, makes them stronger and more resistant to erosion by metal flow. Investment costs are measurably reduced because an appreciably lesser amount of bonding agent is needed. This is attributable to the very desirable particle sizing and the equiaxed, dense grains of CALAMO.

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Forsterite grain is highly refractory magnesium silicate possessing physical properties which make it especially suited for resin-bonded shell molding. Its specific heat, thermal conductivity, high temperature stability and uniform thermal expansion —all contribute to its excellent performance.

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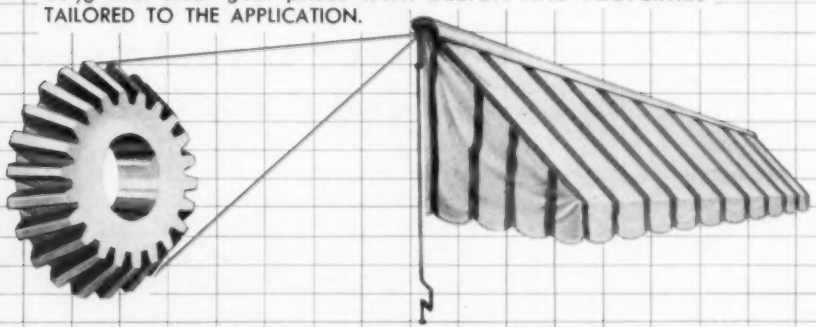

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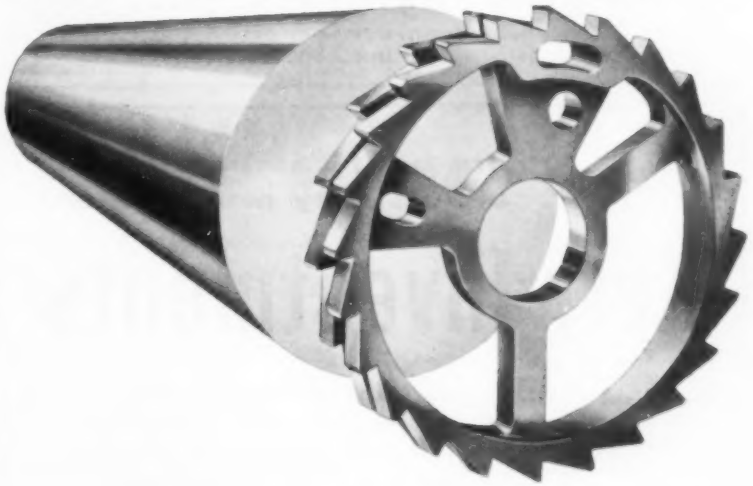

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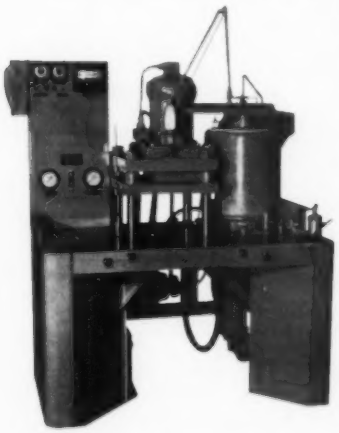

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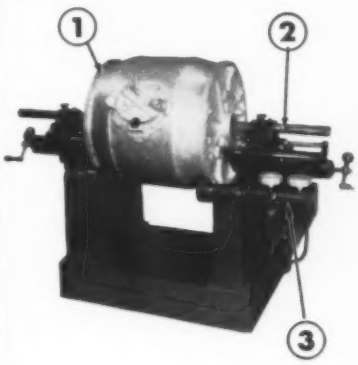

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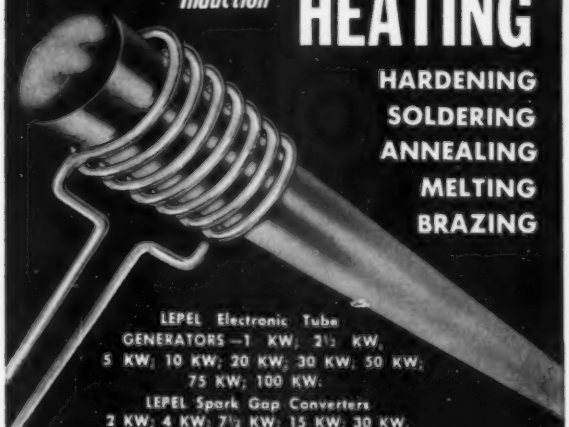

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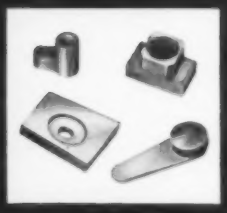

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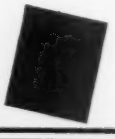

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National Aluminate Corp.
(silica sol-nalcoag)
Pre-Vest, Inc.
Ransom & Randolph Co.
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(Glascast powder and grain)
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Alexander Saunders & Co.
(ferrous and non ferrous)
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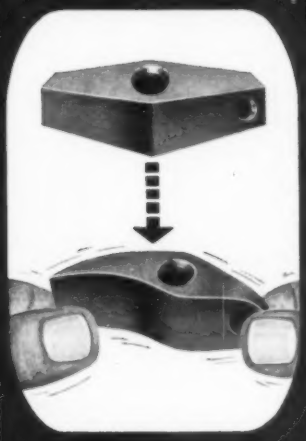
just to *stretch* a point.



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Bareco Wax Co.
Div. of Petrolite Corp.
(wax)

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(wax, plastic, pattern die materials, parting compounds and mold washes)
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Denton Precision Casting Co.
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Pattern Materials Div.
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Kerr Mfg. Co.
(wax, parting compounds and mold washes)
Martin Mfg. Co.
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Perma-Flex Mold Co., The
(wax, pattern die materials, parting compounds and mold washes)
Alexander Saunders & Co.
(wax, pattern die materials, parting compounds and mold washes)
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(pattern die materials)
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Vesuvius Crucible Co.
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(wax, plastic, parting compounds and mold washes, water soluble wax)
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(wax)

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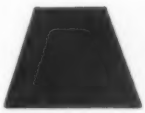

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303	414	5334	5378	5640	30303	51446
304	416	5350	5380	5643	30303F	60303A
308	420	5351	5382	5645	30304	60304
309	430	5352	5385	5665	30310	60310
309+W	430F	5354	5386	5700	30316	60316
310	431	5355	5388	5710	30321	60347
316	431A	5358	5389	5735	30347	60410
321	436	5360	5392	5765	51410	60420
327	440A	5361	5393	6270F	51414	60442
329	440B	5362	5394	6274F	51416F	60446
330	440C	5363	5526	6280C	51420	70310
331	440F	5366	5537	6350	51430	70310A
347	442	5369	5610E	6382	51431	70327
403	446	5370	5616	6428	51440A	70330
406		5372	5621	7834	51440B	70331
		5373	5628		51440C	70446
		5375	5630		51440F	

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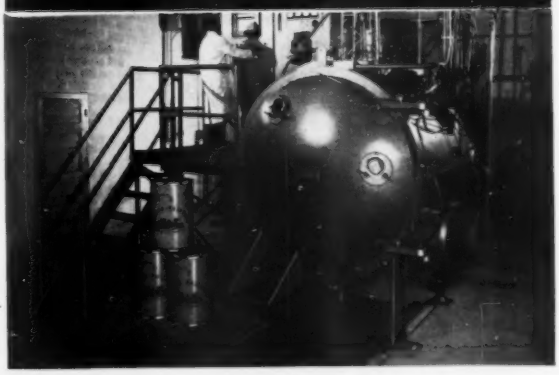

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(vacuum)
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(centrifugal)
Ecco High Frequency Corp.
(centrifugal, vacuum)
Ferriot Bros., Inc.
(vacuum)
Greenwood Engineering Corp.
NRC Equipment Corp.
(vacuum)
Alexander Saunders & Co.
(centrifugal, vacuum, gravity)
Shaw Process Development Corp.
Sta-Warm Electric Co.
(vacuum, gravity)
F. J. Stokes Corp.
(vacuum)

Crucibles

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Casting Supply House
Centrifugal Casting Supply Co.
Denton Precision Casting Co.
Joseph Dixon Crucible Co., The
Electro Refractories & Abrasives Corp.
Lava Crucible-Refractories Co.
Ross-Tacony Crucible Co.
Alexander Saunders & Co.
Shaw Process Development Corp.
Zirconium Corp. of America

Furnace Refractories

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American Refractories & Crucible
Casting Supply House
Joseph Dixon Crucible Co., The
Electro Refractories & Abrasives Corp.
Harbison-Walker Refractories Co.
Kuhlman Electric Co.
Detroit Electric Furnace Div.
Lava Crucible-Refractories Co.
Ross-Tacony Crucible Co.
Alexander Saunders & Co.
Zirconium Corp. of America

Furnaces: Burnout

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Centrifugal Casting Supply Co.
Denton Precision Casting Co.
Alexander Saunders & Co.
Shaw Process Development Corp.

Furnaces: Melting

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Consolidated Electrodynamics
Rochester Div.
(induction, carbon arc)
Ecco High Frequency Corp.
(induction)
Greenwood Eng. Corp.
Hy-Rota Corp.
(induction)
Inductotherm Corp.
(induction)
Jimco Engineering Co.
(fuel fired)
Kuhlman Electric Co.
Detroit Electric Furnace Div.
(carbon arc)
Lepel High Frequency Laboratories, Inc.
(induction)
NRC Equipment Corp.
(induction-vacuum)
Ohio Crankshaft Co., The
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(fuel fired, induction, carbon arc)
Schurs Oil Burner Co.
(fuel fired)
Shaw Process Development Corp.
Surface Combustion Corp.
(fuel fired)

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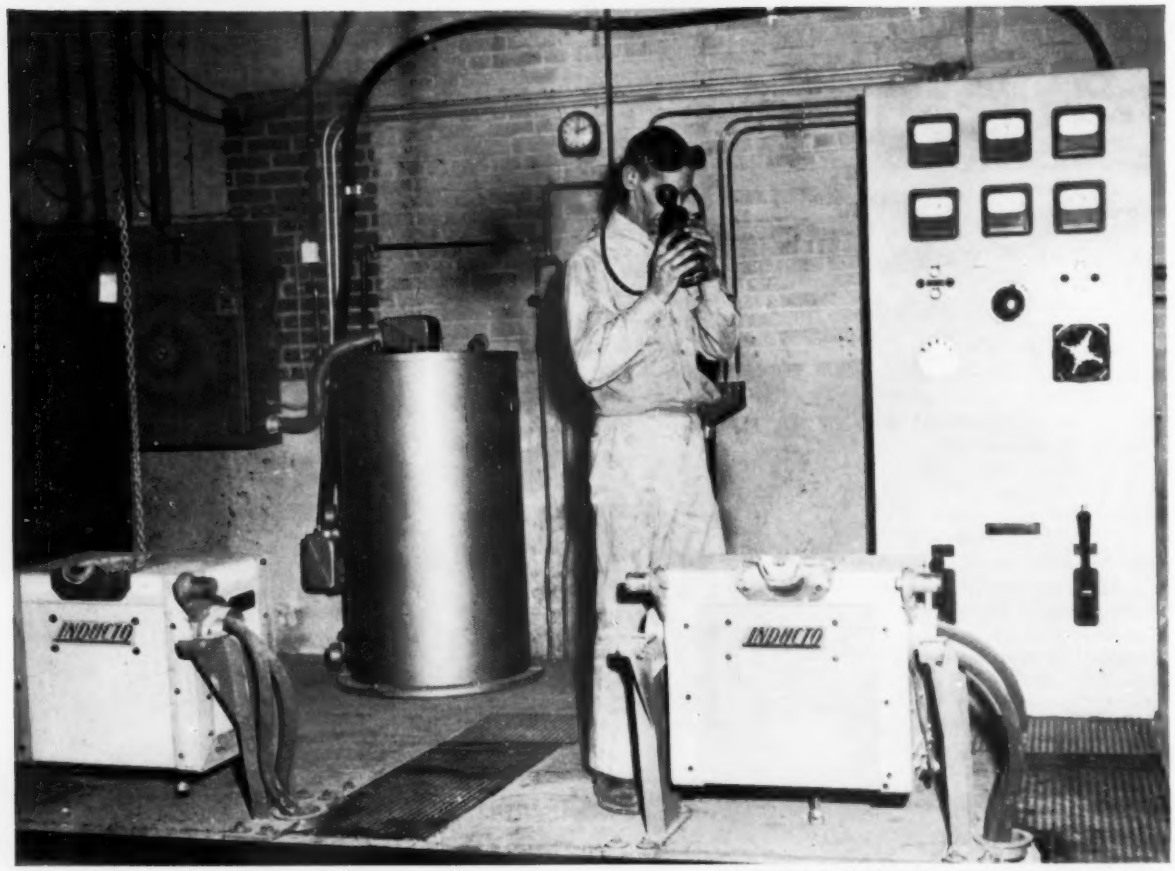

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Casting Supply House
Consolidated Electrodynamics
Rochester Div.
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Denton Precision Casting Co.
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Ecco High Frequency Corp.
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NRC Equipment Corp.
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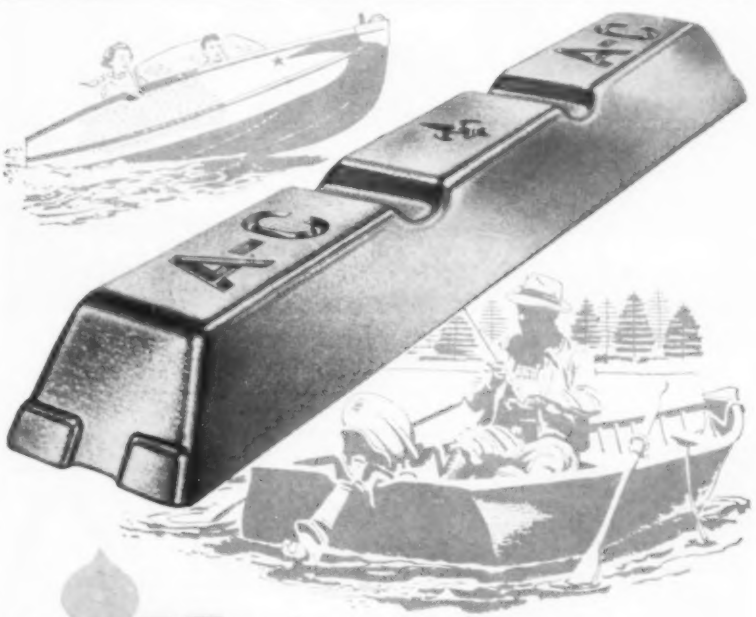

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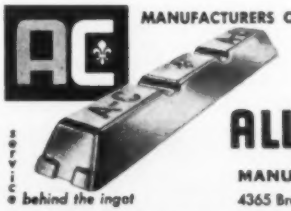

service behind the ingot

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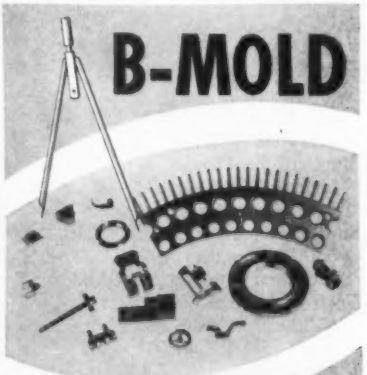

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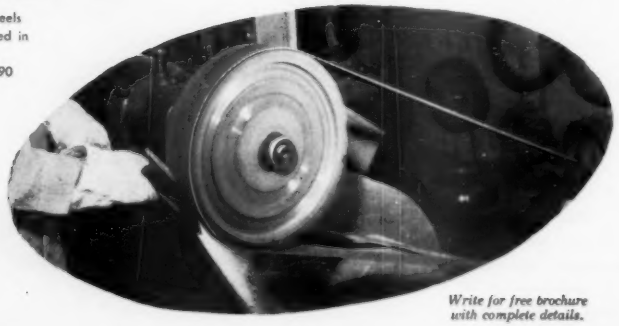

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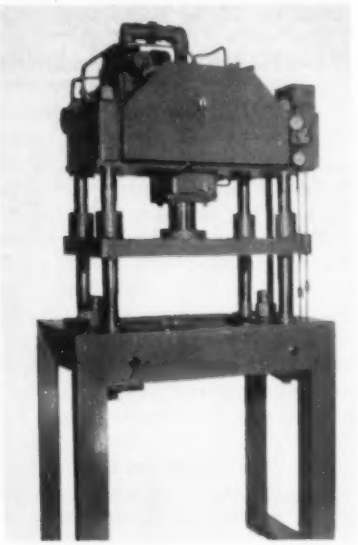
NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 58 of this issue

AIR-HYDRAULIC TRIM PRESS PREVENTS DIE DAMAGE

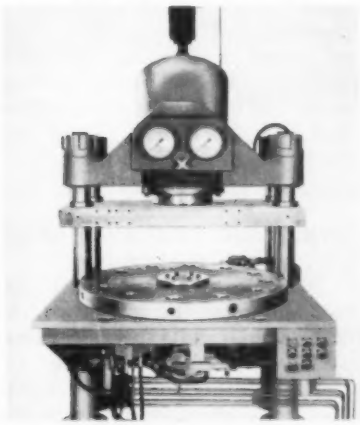


This new air-hydraulic trim press has a built-in air accumulator which forces oil behind the closing ram through a special fast-acting poppet pilot valve, giving ram advance speeds up to 1300 inches per minute. The shut height, position of the stroke and length of stroke are regulated by means of set collars located on the right side of the machine. The power stroke can be set to cut in just prior to entering the trim; thus, if the casting is cocked the press will not reach the power stroke. When the operator removes his hands from the cycle button, the press will retract and save the trim die. The hydraulic circuit is pressurized so there is no dwell when the press enters the trim.

The unit is designed to be moved about the shop with a lift truck. All hydraulics are located on the top crown beam. The base and head of the press are of crown welded construction 8" and 16" thick, respectively, to eliminate deflection. Model 25, first of a new line of presses to be offered to the die casting industry, is a 25-ton press with stroke adjustable from zero to 12". Distance inside the tie bars is 17" x 33"; tie bar diameter is 2½"; area of the lower platen, 31" x 40"; the approach speed is zero to 1300 ipm; return speed, 550 ipm; shut height, 6¼" minimum to 18¼" maximum, pull-out tonnage of 4½. The press was designed and built by B&T Machinery Company.

Circle No. 205 on Reader Service Card

154 TON COMPACTING PRESS HAS AUTOMATIC DIAL FEED



The Rucker Company has developed a 154-ton multi-station hydraulic press for automatic production line fabrication of precision-fused powder metallurgy pieces. The new heavy duty press, designated Model 57-2449, is equipped with fully automatic dial feed or indexing, and is readily convertible to accommodate various die sizes.

The new press will produce up to 15 precision pieces per minute on a 4-second cycle with independently adjustable approach, press, and dwell time. The indexing mechanism also can be regulated independently from press forming operations. A heavy steel turntable is equipped with multiple die stations. A positioning lock device automatically locates each station to within .0003 accuracy.

Automatic sequencing provides split-second timing of each phase of operation: 1. Loading; 2. Pre-tamping; 3. Approach and press; 4. Dwell; 5. Product ejection. An integral push-button control panel provides automatic or manual operation, with automatic interlocks for fail-safe performance.

Circle No. 206 on Reader Service Card

ULTRASONIC CLEANER NOW OFFERED IN LARGE SIZE

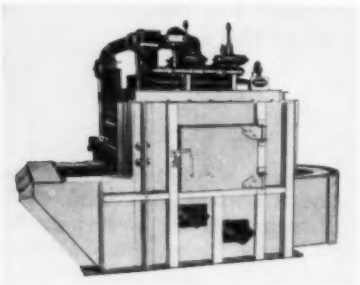
The 150 gallon capacity DR-2000AH system has been added to the line of standard ultrasonic cleaning equipment offered by Acoustica Associates Inc. One of the largest capacity ultrasonic cleaning systems yet to be offered as standard equipment, it has a cleaning tank which is fitted with an array of twenty bottom-mounted transducers. These are driven by a simplified pulsed electronic generator delivering 8,000 watts peak power. Either solvent or water detergent solutions can be used.

The new equipment features the Acoustica Model AT-25OB all-welded stainless steel enclosed transducers, utilizing high temperature ceramic vibrating elements to develop a uniform intensity ultrasonic field across the tank.

Circle No. 207 on Reader Service Card

(Continued on next page)

COMBINATION MELTING-HOLDING FURNACES
. . . reduce contamination

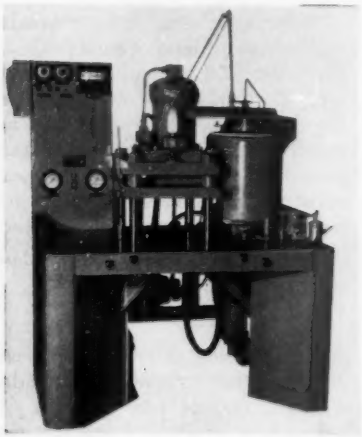


New combination melting-holding furnaces manufactured by Sunbeam Corporation are offered in capacity sizes from 1,200 to 5,000 lbs. The furnaces are gas fired and automatic temperature controlled, and are for use in die casting, permanent mold casting or sand casting of aluminum.

Rejects and back scrap can be charged back on the sloping hearth, eliminating contamination of the inside of the furnace with inserts. The units can be built with or without tap holes for complete draining. A bridged ladle-out well allows constant chlorination and a clean supply of metal. Melt loss is reduced by a deep bath and radiant roof heating.

Circle No. 208 on Reader Service Card

HYDRAULIC WAX INJECTOR
. . . holds temperature to ½°



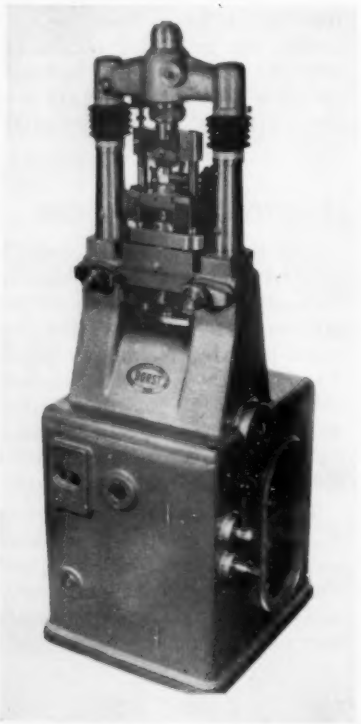
A new side injection wax machine, built by Leyden Tool Works, features all-hydraulic operation and extremely close control of temperature. Completely self-contained, the unit has two hydraulic pumps, one for clamping and one for injection, both are adjustable to deliver clamping pressure up to 20 tons, and injection pressure of 50 psi to 2000 psi.

The wax, wax unit and nozzle of the equipment are heated by forced, circulating oil, temperature controlled by an indicating pyrometric proportioning instrument. The nozzle moves to and retracts from the die seat hydraulically, with adjustable speed. After each cycle, the wax cylinder is completely purged, automatically.

Measurements are 37" x 63" x 74" high; weight, approximately 2500 lbs. The attractive unit comes complete with a universal movement fluorescent lamp for ample illumination.

Circle No. 40 on Reader Service Card

TWO TON POWDER PRESS
. . . is versatile & fast



A new high-speed two ton automatic press has been designed for the production of small metal and ceramic powder parts including memory cores. Built by Dorst Division of Arnhold Ceramics, Inc., the unit features an easily removable self aligning tool holder to accomodate conventional punches, dies and core rods. Pressing tools are mounted and aligned in the tool holder outside of the machine and can be exchanged with very little down-time of the machine by using an additional tool holder.

The press develops up to 2 tons of pressure at 27 to 84 strokes per minute. Max. diameter is ½ in.; fill, .315 in. mix. Power is by a ½ hp variable speed motor.

Circle No. 210 on Reader Service Card

BARREL FINISHING MACHINE
. . . has built-in media separator

The DBO-2A barrel finishing machine is well suited for use in plants with limited finishing work, research departments, job shops, and as an auxiliary unit for deburring and finishing of special parts. Requiring less than 12 sq. ft. of floor area for installation, the machine can handle total work loads up to 700 lbs. The unit features a twin compartment, 5.6 cu. ft. neoprene-lined barrel and built-in screening drawers to handle discharged loads from each compartment. This eliminates the need for accessory media separator equipment, and allows simultaneous deburring and finishing of different types of work parts in one machine. A wide range of barrel speeds from 8 to 38 rpm adds to the ability of the unit to perform all types of finishing operations requiring close tolerance specifications. The equipment was designed and built by Almco, Queen Products, Inc.

Circle No. 211 on Reader Service Card

HYDRAULIC TRIMMING PRESS
. . . gives high accuracy

This new production die cast trimming unit features 4 tie rod construction and extended bronze guide bushings for carrying the platen with exacting parallelism. The press has a 35 ton capacity, 22 sq. in. bed area, 12 in. stroke, and opens to 18 in.

A 7½ hp motor drive with Hi-Lo JIC hydraulic system gives 200 ipm advance, 400 ipm return speeds. For operator safety, the press is automatically actuated by closing a safety gate. The unit was built by M & N Modern Hydraulic Press Co., Inc., and designated Model 1R; similar presses are available in capacities up to 100 tons.

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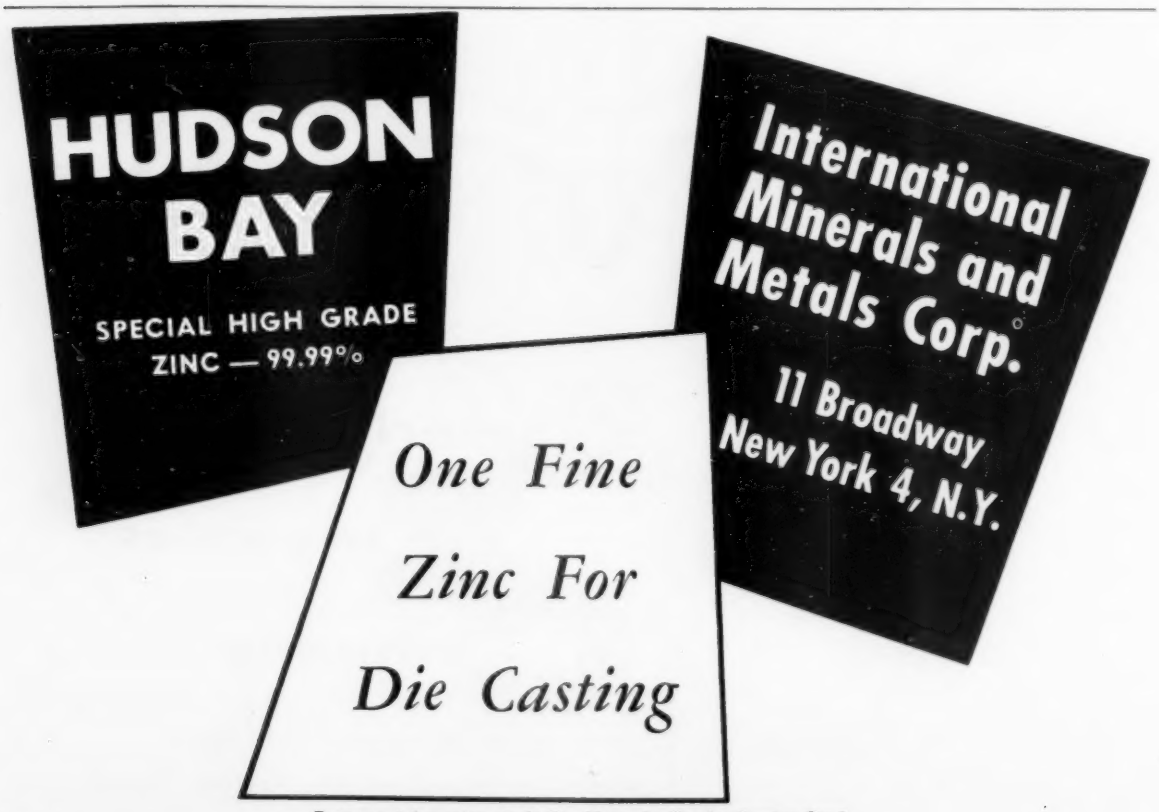
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FIRST in commercial production and sale of zinc base die casting alloy ingot containing 4% aluminum made from high grade zinc. Production started October, 1924.

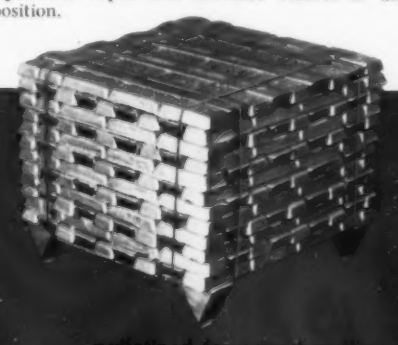
FIRST to use 99.99 plus pure zinc when it became available in 1928.

FIRST to develop the lower magnesium contents, .03 to .05%, which eliminated the hot shortness characteristics experienced with .10% magnesium and at the same time was sufficient to prevent the intercrystalline corrosion. Apex promoted in 1931 the first ASTM specification written for zinc base die casting alloys.

FIRST to establish and publish information on the effects of metal and die temperatures on different alloy compositions through actual die casting of thousands of test bars. Apex "Metalgrams" showing these effects were initiated in 1931 and continued through 1945.

FIRST to use large capacity refractory lined furnaces for alloying, replacing the conventional iron metal pots. The larger heats established a uniformity of composition not previously attainable. Iron pickup also was eliminated.

FIRST to employ Quantometers—direct reading spectrographs—for rapid and accurate control of alloy composition.



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